CHAPTER 3: COHO SALMON STOCK STATUS AND ESCAPEMENT GOALS IN SOUTHEAST ALASKA

by

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ABSTRACT

The status of coho salmon stocks in Southeast Alaska was assessed from information on escapement, smolt abundance, marine survival and total abundance from coded wire tagged indicator stocks and streams that were surveyed for escapement. The escapement trend since the early to mid-1980s has been relatively level for most stocks, with a peak in the early to mid-1990s. Escapements to most systems have remained high during 2001–2004 as a result of continued strong returns and moderate exploitation rates.

As part of a triennial review of the region's salmon escapement goals, several changes to coho escapement goals were made in 2005. *Biological escapement goals* were established for index counts and total escapements to the Chilkat River and for aggregate survey counts in streams in the Ketchikan and Sitka areas. Goals were changed for two Juneau roadside streams (Montana and Peterson creeks) and eliminated for three others (Steep, Jordan and Switzer creeks). Goals were also eliminated for three Yakutat area stocks that are no longer routinely or consistently surveyed.

Escapements were assessed relative to current objectives for stocks that have goals. With very few exceptions, observed escapements were within or above goal since 1990. Smolt production from Auke Creek continued a long-term declining trend of 1.5%/year from 1980 to 2004 despite stable, high levels of spawning escapement that exceeded the goal range in 21 of 25 years. Smolt production from the Taku River and Ford Arm Lake has trended higher in the past decade while trends have been stable for the Berners River and Hugh Smith Lake. We identified no coho salmon *stocks of concern* in Southeast Alaska.

Recent marine survival rates have been moderate-to-high, on average. In most cases, marine survival of 2003 and 2004 returning adults was near average for the prior eight years but below peak levels in the early 1990s. Average marine survival rates for four long-term indicator stocks during 1995–2004 ranged from 10–22% with a mean-average of 15%.

Exploitation rates increased substantially in 2004 following a period of low exploitation rates that were likely influenced by low salmon prices during 2000–2003. In particular, 2004 troll fishery exploitation rates increased to a level that was in most cases equal to or higher than average rates prior to 2000. Drift gillnet exploitation rates remained reduced from pre-2000 averages in most cases. However, marine sport exploitation rates have trended upward with increased charter activity. During 2000–2004, marine sport exploitation rate estimates reached as high as 5–13% for some stocks, including the Taku River, Ford Arm Lake and Chuck Creek. In addition to assessing stock abundance, fishery managers will need to continue to account for fluctuating fishing effort and efficiency in order to achieve escapement goals.

Key words: coho salmon, *Oncorhynchus kisutch*, escapement, escapement goals, smolts, marine survival, exploitation rates, Auke Creek, Berners River, Taku River, Ford Arm Lake, Hugh Smith Lake, Chilkat River, Chuck Creek.

INTRODUCTION

Coho salmon (*Oncorhynchus kisutch*) are important to a variety of commercial, sport, and subsistence users in Southeast Alaska. Trollers have accounted for over 60% of the commercial catch, on average, but coho salmon are also important to seine, drift gillnet and set gillnet fisheries. Recreational fisheries occur in both fresh and saltwater areas and have constituted an increasing component of the catch in recent years. Directed subsistence fisheries have been very limited, but regulations allowing directed subsistence fishing for coho salmon have been recently expanded under federal rules in many freshwater areas. This report updates an earlier assessment (Shaul et al. 2004) of the stocks that support these fisheries through the 2004 return.

Full development of a troll fishery targeting coho salmon occurred around 1940, and the commercial catch (Figure 3.1) provides an indication of the trend in coho salmon abundance after that time. Stocks recovered in the early 1980s from a prolonged period of low abundance

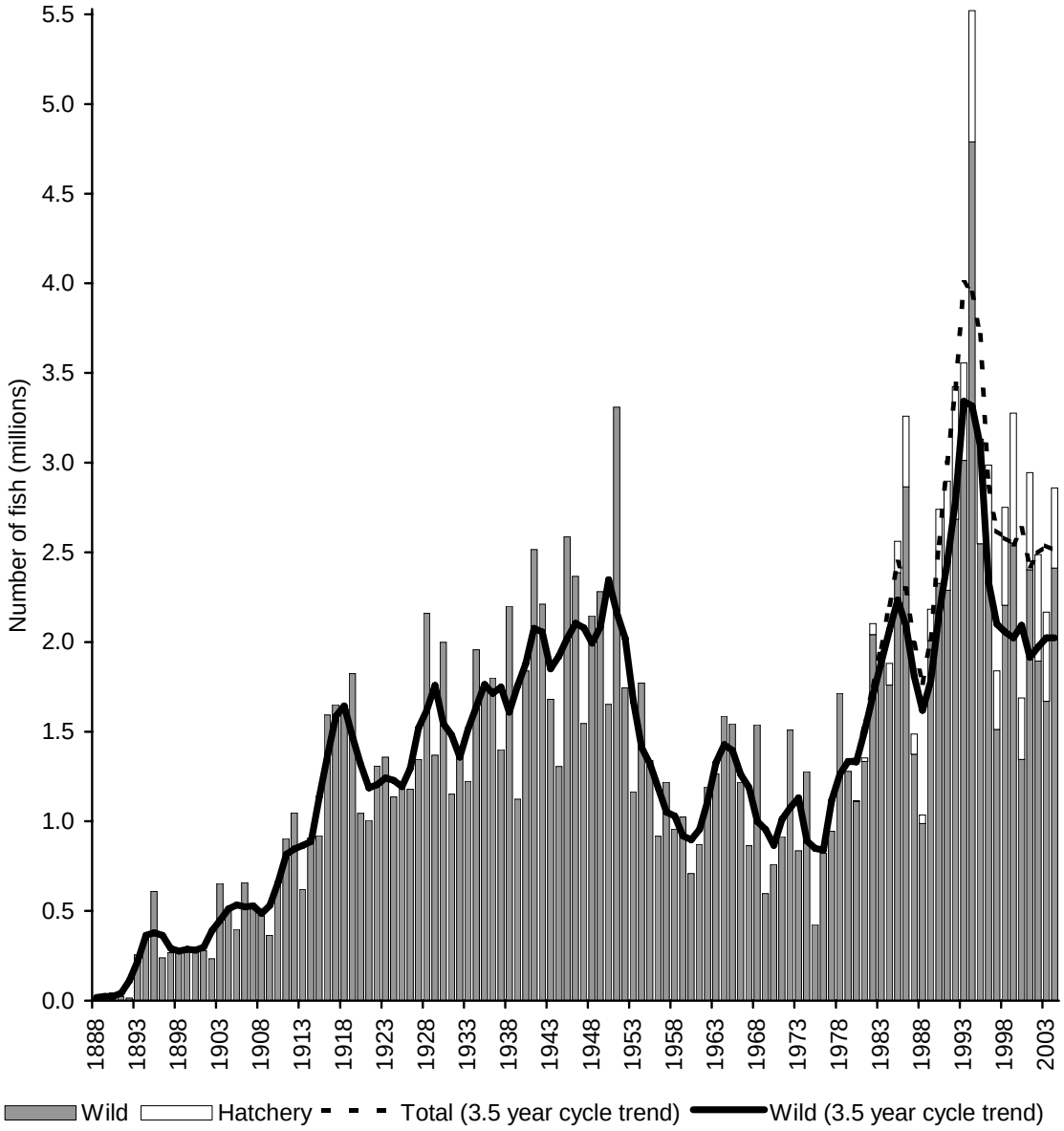

Figure 3.1–Commercial harvest of wild and hatchery coho salmon in Southeast Alaska, 1888–2004.

extending for over 2 ½ decades. Whereas poor marine survival was likely a major factor driving poor catches from 1956 to 1981, improved marine survival has been an important factor influencing larger wild stock catches since 1982. Abundant commercial wild coho salmon catches of 1.67 million fish in 2003 and 2.42 million fish in 2004 suggest a continuation of the recent trend of high wild stock abundance.

Excellent coho salmon habitat occurs throughout Southeast Alaska (Figure 3.2). In addition to wild stocks within Southeast, important contributions to the region's total harvest are made by local hatchery stocks, several transboundary rivers, and by natural systems and hatcheries on the

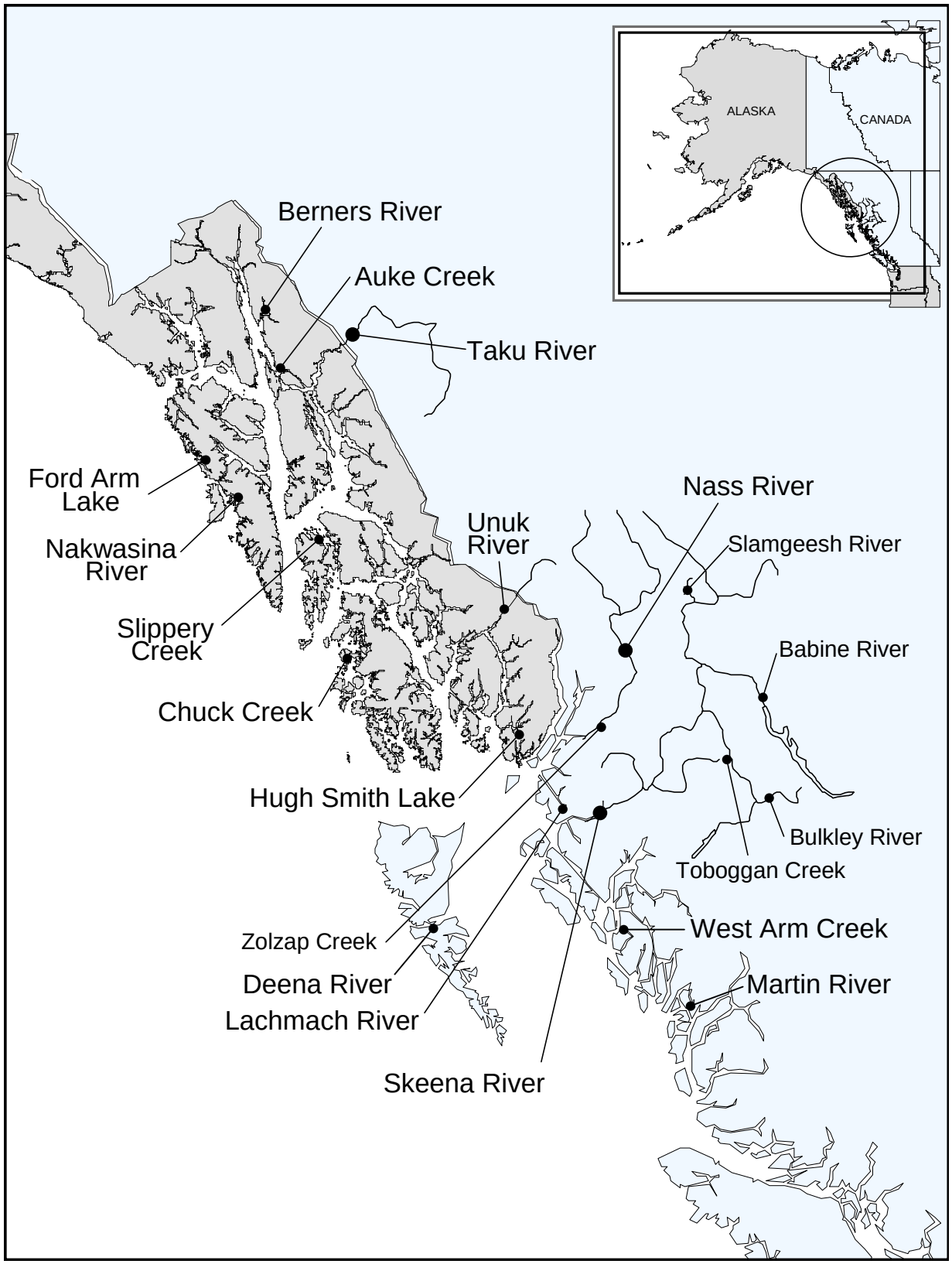

Figure 3.2–Map of Southeast Alaska and northern British Columbia, showing the locations of coho salmon full indicator stock assessment projects.

northern British Columbia coast. Coho salmon are produced by thousands of streams and by 13 hatcheries in Southeast Alaska. Many of the streams are small producers about which little is known. During 1995 to 2004, hatcheries contributed an average of 20% (range 15% to 24%) of the Southeast Alaska commercial catch, of which over 97% was produced by Alaskan facilities (Integrated Fisheries Database, ADF&G, Douglas, AK).

The Alaska Department of Fish and Game implemented an improved stock assessment program in the early 1980s to better understand and manage coho salmon stocks. New assessment projects were implemented to monitor population and fishery parameters for indicator stocks (Shaul 1994; Shaul and Crabtree 1998). In addition, a systematic escapement survey program was developed. These programs have bettered the understanding among fishery researchers and managers of the status of Southeast Alaska coho salmon stocks and have formed the basis for improved management.

The principal management objective for Southeast Alaska fisheries for coho salmon is to achieve *maximum sustained yield* from wild stocks. Hatchery contributions and natural production are identified inseason in key fisheries using coded wire tags. Fisheries directed primarily at coho salmon are managed based on wild stock fishery performance to achieve adequate escapement while harvesting the surplus. *Biological escapement goal* ranges have been established for a number of wild indicator stocks and surveyed systems.

A secondary management objective is to achieve long-term commercial gear-type allocations that were established by the Alaska Board of Fisheries in 1989. These allocations preserve a 1969 to 1988 historical base distribution of 61% for troll gear, 19% for purse seine gear, 13% for drift gillnet gear, and 7% for set gillnet gear.

The wide distribution of coho salmon production across thousands of small stream systems necessitates that much of the harvest occur in highly mixed-stock fisheries where the stocks intermingle. Except for years of strong deviations from average abundance, commercial trollers fish a relatively stable season and harvest a relatively stable proportion of the total run. This pattern of fishing results in a more even distribution of the troll harvest across all stocks in the region, thereby realizing some harvest from all stocks, while insuring that more heavily exploited inside stocks are able to support some harvest in inside fisheries while still maintaining escapement. Most active management to harvest surpluses and achieve escapements is conducted in gillnet fisheries, based on returns to single major systems or local concentrations of productive systems. Nearly all of the harvest of many small to medium stocks on the outer coast and along inside passages occurs in the commercial troll and marine sport fisheries, with a small incidental harvest by purse seine fisheries for pink salmon.

The commercial fisheries are managed under specific management plans for each fishery. The troll management plan for coho salmon contains several decision points that potentially trigger early or midseason closures for conservation and allocation, and an extension of the troll coho season for up to 10 days after the regulatory closing date of September 20. Most provisions of the plan were written in the late 1970s and 1980s when direct information on coho stocks was very limited, aside from fishery catch and effort. In recent years, fishery managers have tried to balance the specific provisions of the management plan with increasing capability to assess stocks and their escapement needs. Inseason management has increasingly focused on escapement goals that produce *maximum sustained yield* as a specific priority objective.

In addition to provisions specified in the management plans, the Pacific Salmon Treaty contains provisions for the conservation of northern British Columbia coho stocks. The Pacific Salmon Treaty provisions are essentially the same as Board of Fisheries management plan provisions for potential early and midseason troll fishery closures. However, the Pacific Salmon Treaty also contains provisions that trigger a closure of the troll fishery in boundary areas of Southern Southeast and in northern British Columbia when abundance of northern British Columbia stocks is indicated to be low based on fishery performance.

Marine sport fisheries are managed primarily under a 6-fish bag limit. The same bag limit applies in most freshwater systems, except for some more accessible streams where the bag limit is two fish. The sport fishery has accounted for a small but increasing component of the catch, reaching 13% of the all-user region harvest in 2003 (Figure 3.3). Although emergency inseason management actions have been less frequent in the recreational fisheries, seasons have been closed or bag limits reduced in both marine and freshwater fisheries in response to inseason indicators of low abundance. Bag limits were increased in some locations to harvest the very large 1994 return.

Small subsistence coho salmon fisheries occur in Southeast Alaska, primarily in terminal areas near Yakutat and Angoon. These fisheries have not been actively managed, but harvest levels are monitored through permit returns. The reported harvest during 1995 to 2004 averaged only 2,396 fish (Integrated Fisheries Database, ADF&G, Douglas, AK).

STOCK STATUS

Status of coho salmon stocks in the Southeast region was judged by trends in abundance and escapement of indicator stocks relative to established goals. Coho salmon stocks are very widely distributed and are believed to be present in over 2,500 primary anadromous streams; however it is practical and feasible to conduct stock assessment projects on only a small fraction of those streams. Most direct assessment of the stocks occurs at two levels: full indicator stock and escapement indicator.

FULL INDICATOR STOCKS

Full indicator stocks are marked as smolts or pre-smolts with coded wire tags, which makes it possible to estimate their smolt production (from the marked rate at return) and contribution to the fisheries by systematically sampling fishery harvests and escapements.

These programs have been expanded in recent years and are now well established in seven systems in the region (Figure 3.2). The data series extends from the early 1980s for four systems (Auke Creek, Berners River, Ford Arm Lake, and Hugh Smith Lake). Programs were expanded in the 1990s to include the Taku River, Unuk River, Nakwasina River, Chilkat River and Slippery Creek. In addition, Chuck Creek, which was added as an indicator stock in 2001, has total run estimates for three earlier years (1982, 1983, and 1985). However, the Unuk River project was discontinued in 2003 and the project at Slippery Creek, where escapement estimation has been difficult, is scheduled for discontinuation after 2005.

Full indicator stock programs provide detailed population information needed to establish and manage for *biological escapement goals*. Specific parameters that are estimated for these stocks include: total adult abundance, spawning escapement (including age, size, and sex), smolt production (abundance, age, size), marine survival, fishery contributions by area, gear type and time, and exploitation rates. Over time, these parameters are used to evaluate the relationship

Figure 3.3–Sport harvest in saltwater and freshwater of coho salmon in Southeast Alaska, 1977-2004

between spawning escapement and production and to establish *biological escapement goals* that produce *maximum sustained yield*. One major advantage of the smolt estimation programs associated with coho indicator stocks is that they make it possible to filter out variation in return abundance caused by variation in marine survival and to improve resolution of the relationship between escapement and brood-year production.

In 1994, *biological escapement goals* were established for the four long-term indicator stocks based on Ricker spawner-recruit relationships (Clark et al. 1994). A *biological escapement goal* of 30,000-70,000 spawners was recently developed for the Chilkat River (Ericksen and Fleischman *in prep*). Also, for the Taku River a minimum inriver abundance goal of 38,000 spawners is specified in the 1999 Pacific Salmon Treaty. In practical terms, the abundance goal upriver of the US/Canada border translates into an escapement goal of about 35,000 fish after inriver harvests by commercial, food and test fisheries.

ESCAPEMENT INDICATORS

Foot or helicopter surveys have been systematically carried out on sets of streams in the Juneau, Haines, Sitka, and Ketchikan areas. These projects provide greater coverage but a much lower level of resolution about stock status compared with full indicator stocks. High and variable rainfall in the fall months makes it difficult to obtain consistent surveys. In the Juneau area, repetitive foot surveys are conducted on five streams of which two have individual goals (Clark *in prep*). In the Haines area, surveys are conducted on four tributaries of the Chilkat River (Ericksen and Fleischman *in prep*). In the Sitka area, five local streams have been surveyed on foot most years since 1985, and the Black River north of Sitka has been surveyed by helicopter since 1984. In the Ketchikan area, surveys have been conducted by helicopter on 14 streams since 1987. *Biological escapement goals* for the aggregate survey counts in the Ketchikan and Sitka areas were developed recently by Shaul and Tydingco (*in prep*).

Only peak survey counts that met standards for timing, survey conditions, and completeness were included in the indexes. Interpolations were made for missing counts under the assumption that the expected value is determined for a given stream and year in a multiplicative way (i.e., counts across streams for a given year are multiples of counts for other years, and counts across years for a stream are multiples of counts for other streams). The estimated expected count for a given stream, in a given year, is then equal to the sum of all counts for the year, times the sum of all counts for the stream, divided by the sum of counts over all streams and years. If there is more than one missing value, an iterative procedure, as described by Brown (1974), must be used since the sums change as missing counts are filled in at each step. Most of the consistent indicators of coho salmon escapement were established in the early to mid-1980s (Table 3.1).

NORTHERN INSIDE AREA STOCKS

Escapement to Auke Creek, a stream on the Juneau road system having a weir, has been consistently within or above escapement goal since the early 1980s (Figure 3.4; Table 3.2). Goals have recently been revised for surveyed Juneau roadside streams (Clark *in prep*). The goal for the largest producer, Montana Creek, was increased from 200–500 to 400–1,200 while the goal for Peterson Creek was changed from 100–350 spawners to 100–250 spawners. Goals were eliminated for the other three Juneau roadside streams (Steep, Jordan and Switzer Creeks).

The current goal for Peterson Creek has been met annually since surveys were initiated in 1981 while the current goal for Montana Creek was not met in 5 years out of 24 (1981, 1986-1988, and 2004). Peak counts have been extremely variable in Jordan Creek, ranging from only 18 spawners in 1997 to 1,396 spawners in 2002. Shaul et al. (2004) attributed the spike in escapement in 2002 to an unusually strong 2001 smolt migration. Brood year escapement counts for the 2002 return were low (47–63 spawners), suggesting that improved seeding was not a factor. They suggested that wide variation in smolt production from Jordan Creek may reflect intermittent movement of juveniles into Jordan Creek from other systems prior to final sea-migration. Such movement was evidenced by recovery of a coded-wire tagged smolt from Jordan Creek in 2002 that had been tagged in the Chilkat River in 2001 (Brian Glynn, Alaska Department of Fish and Game, Douglas, personal communication). However, the reason for the increased frequency of low counts since 1994 is unclear, but may reflect human-caused habitat changes in this largely urban stream.

Strong escapements relative to goals for most Juneau area streams in most years reflect high marine survival rates and moderate exploitation rates for roadside stocks since the early 1980s. Auke Creek and surveyed stocks on the Juneau roadside are harvested primarily in highly mixed-stock troll, seine, and sport fisheries, with only light exploitation in inside gillnet fisheries.

The Berners River in lower Lynn Canal, Chilkat River in upper Lynn Canal and the Taku River south of Juneau all had relatively strong escapements at or above goal during 1999–2004, with a peak in 2002 (Figure 3.4; Table 3.2). All three of these systems support similar mainland valley rearing habitat, including wetlands, ponds and sloughs, and their coho salmon runs are targeted by drift gillnet fisheries in addition to the troll fishery.

The Berners River is a compact system with concentrated high quality coho spawning and rearing habitat. Although a substantially smaller producer than the Taku and Chilkat Rivers, the Berners River is an important contributor to the fisheries in northern Southeast. Escapement counts in the Berners River peaked at 27,700 spawners in 2002.

Table 3.1–Southeast Alaska coho salmon escapement estimates and index counts from 1980 to 2004.

Year	Auke Creek	Juneau roadside index[a]	Berners River	Chilkat River	Taku River	Ford Arm Lake	Black River	Sitka survey index[b]	Hugh Smith Lake	Ketchikan survey index[c]	Chuck Creek
1980	698										
1981	646	1,552									
1982	447	1,545	7,505			2,662		1,545	2,144		1,017
1983	694	1,287	9,840			1,938		457	1,490		1,238
1984	651	1,312	2,825				425	2,063	1,408		
1985	942	1,466	6,169			2,324	1,628	1,246	903		956
1986	454	887	1,752			1,546	312	702	1,783		
1987	668	945	3,260	1,113	55,457	1,694	262	293	1,118	4,933	
1988	756	1,127	2,724	877	39,450	3,028	280	403	513	5,007	
1989	502	1,241	7,509	1,452	56,808	2,177	181	576	433	6,761	
1990	697	2,518	11,050	3,383	72,196	2,190	842	566	870	3,533	
1991	808	2,641	11,530	2,513	127,484	2,761	690	1,510	1,826	5,721	
1992	1,02	4,405	15,300	2,307	84,853	3,847	866	1,899	1,426	7,017	
1993	859	2,351	15,670	1,731	109,457	4,202	764	1,716	830	7,270	
1994	1,43	2,916	15,920	5,781	96,343	3,228	758	1,965	1,753	8,690	
1995	460	1,405	4,945	1,687	55,710	2,445	1,265	1,487	1,781	8,627	
1996	515	1,291	6,050	1,110	44,635	2,500	385	1,451	950	8,831	
1997	609	1,471	10,050	1,294	32,345	4,965	686	809	732	5,063	
1998	862	1,516	6,802	1,460	61,382	7,049	1,520	1,242	983	7,070	
1999	845	1,762	9,920	1,699	60,844	3,598	1,590	776	1,246	8,038	
2000	683	1,355	10,650	2,635	64,700	2,287	880	803	600	8,634	
2001	865	1,760	19,290	3,232	104,460	2,178	1,080	1,515	1,580	11,475	1,350
2002	1,17	4,543	27,700	5,660	219,789	7,109	1,194	1,868	3,291	12,223	2,189
2003	585	1,589	10,110	3,950	167,919	6,789	1,055	1,101	1,510	11,859	614
2004	416	837	14,450	2,006	132,706	3,539	380	1,124	840	9,904	606
Goal range											
Lower	200		4,000	950[f]	35,000[d]	1,300		400[e]	500	4,250[e]	
Upper	500		9,200	2,200[f]		2,900		800[e]	1,100	8,500[e]	

[a] The Juneau roadside index is the sum of peak survey counts on five streams.

[b] The Sitka survey index is the sum of peak survey counts on five streams.

[c] The Ketchikan survey index is the sum of peak survey counts on 14 streams.

[d] For the Taku River stock of coho salmon, the management objective of the U.S. is to insure a minimum above-border run of 38,000 fish as specified in the Pacific Salmon Treaty. The listed figure of 35,000 fish, shown for comparison with spawning escapement estimates, reflects a probable Canadian catch above the border of up to 3,000 fish in non-coho directed fisheries when the total above-border run is 38,000 fish.

[e] Goal range recommended by Shaul and Tydingco (*in prep*).

[f] Goal range recommended by Ericksen (*in prep*).

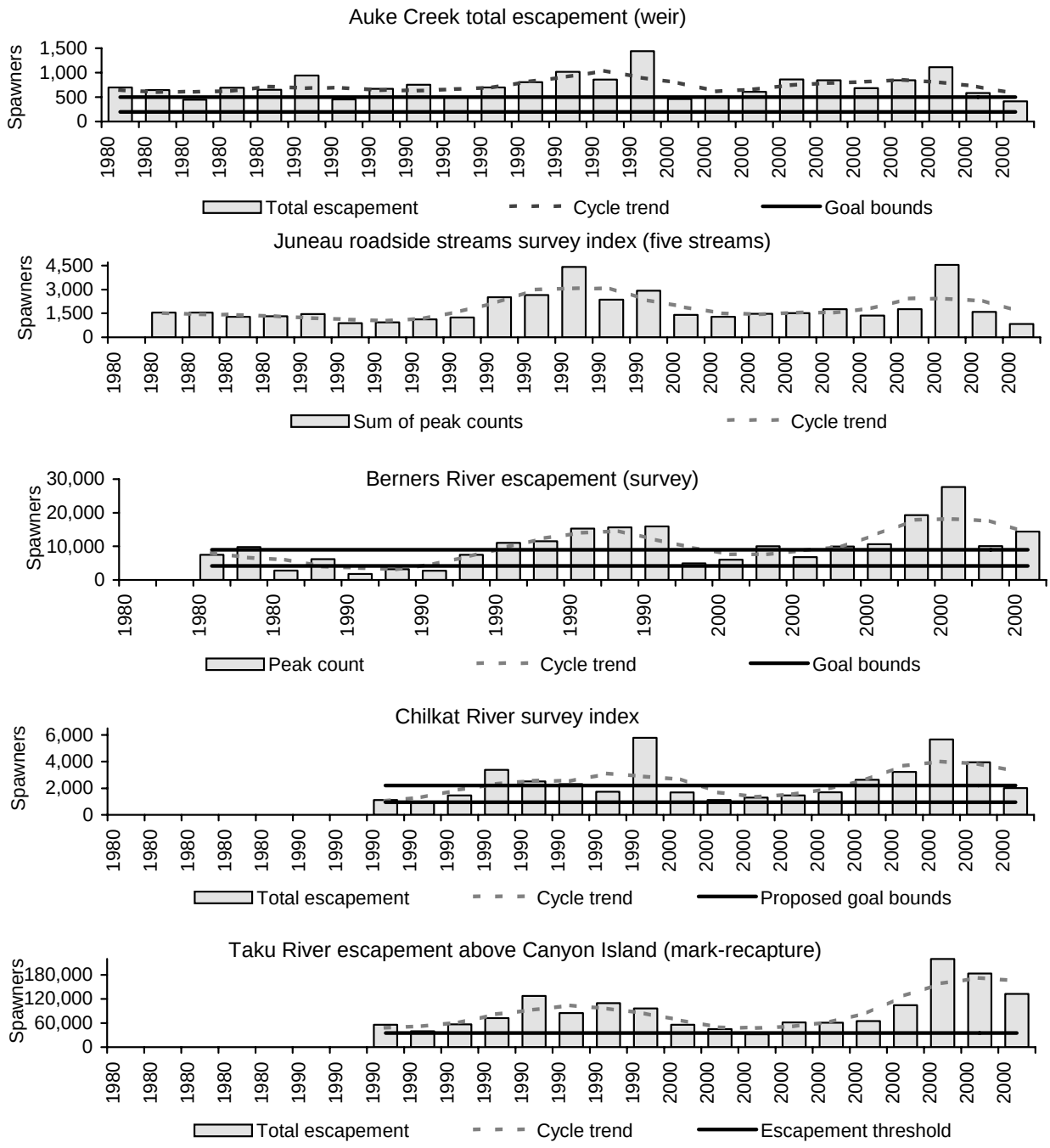

Figure 3.4–Coho salmon escapement estimates and indexes for streams in the Northern Inside area (Districts 111 and 115). Also shown are 3½-year moving average "cycle" trends and escapement goal ranges. The threshold of 35,000 shown for the Taku includes the inriver run threshold of 38,000 under the Pacific Salmon Treaty minus an allowance for a catch of 3,000 fish in inriver commercial, food, personal use and test fisheries.

Table 3.2–Peak coho salmon escapement survey counts for Juneau roadside streams and total count of wild adult coho salmon at the Auke Creek weir from 1981 to 2004.

	Juneau roadside peak surveys								Chilkat River		
Year	Auke Cr (weir)	Montana Creek	Steep Creek	Jordan Creek	Switzer Creek	Peterson Creek	Roadside survey index[a]	Berners River	Index count	Expanded estimate	Taku River
1981	646	227	515	482	109	219	1,552				
1982	447	545	232	368	80	320	1,545	7,505			
1983	694	636	171	184	77	219	1,287	9,840			
1984	651	581	168	251	123	189	1,312	2,825			
1985	942	810	186	72	122	276	1,466	6,169			
1986	454	60	247	163	54	363	887	1,752			
1987	668	314	128	251	48	204	945	3,260	1,113	35,800	55,457
1988	756	164	155	215	51	542	1,127	2,724	877	28,209	39,450
1989	502	566	222	133	78	242	1,241	7,509	1,452	46,704	56,808
1990	697	1,711	185	216	82	324	2,518	11,050	3,383	79,807[b]	72,196
1991	808	1,415	267	322	227	410	2,641	11,530	2,513	80,831	127,484
1992	1,020	2,512	612	785	93	403	4,405	15,300	2,307	74,205	84,853
1993	859	1,352	471	322	94	112	2,351	15,670	1,731	55,678	109,457
1994	1,437	1,829	200	371	198	318	2,916	15,920	5,781	185,948	96,343
1995	460	600	409	77	42	277	1,405	4,945	1,687	54,263	55,710
1996	511	798	134	54	42	263	1,291	6,050	1,110	35,704	44,635
1997	609	1,018	182	18	67	186	1,471	10,050	1,294	41,622	32,345
1998	862	1,160	149	63	42	102	1,516	6,802	1,460	50,758[b]	61,382
1999	845	1,000	392	47	51	272	1,762	9,920	1,699	54,649	60,768
2000	683	961	88	30	74	202	1,355	10,650	2,635	84,756	64,700
2001	842	1,119	366	119	50	106	1,760	19,290	3,232	103,958	104,394
2002	1,112	2,448	380	1,396	124	195	4,543	27,700	5,660	205,429[b]	219,360
2003	585	808	400	78	100	203	1,589	10,110	3,950	134,340[b]	183,038
2004	416	364	82	38	69	284	837	14,450	2,006	64,524	132,405
Avg.	729	958	264	252	87	260	1,822	10,044	2,438	78,733	88,932
Goals:											
Point	340							6,300	1,550	50,000	
Lower	200	400				100		4,000	950	30,000	35,000[c]
Upper	500	1,200				250		9,200	2,200	70,000	

[a] The roadside index is the sum of peak survey counts on five streams in the Juneau area.

[b] Mark-recapture estimates of Chilkat River escapement. Other estimates are expanded index counts.

[c] For the Taku River stock of coho salmon, the management objective of the U.S. is to insure a minimum above-border run of 38,000 fish as specified in the Pacific Salmon Treaty. The listed figure of 35,000 fish, shown for comparison with spawning escapement estimates, reflects a probable Canadian catch above the border of up to 3,000 fish in non-coho directed fisheries when the total above-border run is 38,000 fish.

The Taku River may be the single largest coho salmon producing system in the region. Escapement estimates were first made in 1987 and run reconstruction estimates are available since 1992 (Elliott and Bernard 1994; McPherson et al. 1994, 1997, 1998b; McPherson and Bernard 1995, 1996; Yanusz et al. 1999, 2000; Jones et al. *in prep*). The inriver run past Canyon Island near the US/Canada boundary is estimated using a mark–recapture technique. Marking is done at

research fishwheel sites in the Canyon while recovery sampling is done in test and Canadian commercial fisheries. Results of a 1991 radio-telemetry study indicated that the fishwheel estimate represented about 78% of the total system escapement with about 22% spawning in Alaskan waters below Canyon Island (Eiler et al. *in prep*).

Based on the 1999 Pacific Salmon Treaty agreement, the management intent of the U.S. is to ensure a minimum above-border inriver run of 38,000 coho salmon with the following provisions: (1) no numerical limit on the Taku River coho salmon catch will apply in Canada during the directed sockeye salmon fishery (through Statistical Week 33); depending on inseason projections of above-border run size, directed Canadian harvests are: (2) 3,000 coho salmon for above-border runs less than 50,000 (3) 5,000 coho salmon for above-border runs between 50,000 and 60,000, (4) 7,500 coho salmon for above-border runs between 60,000 and 75,000, and (5) 10,000 coho salmon for above-border runs above 75,000.

The inriver run estimate past Canyon Island has exceeded 38,000 spawners in all years except 1997 when the estimate was only 35,035 fish, including an inriver catch of 2,690 fish and escapement estimate of 32,345 spawners (Table 3.2), despite timely implementation of extensive inseason restrictions in troll, gillnet, and sport fisheries. In the early 1990s, the Taku River coho run increased sharply and greatly exceeded the current management goal despite increased fishing effort in the District 111 gillnet fishery, which targets the stock in late August and September.

Since 1998, Taku inriver run estimates have ranged above the management goal by an increasing margin because of increasing run sizes associated with increasing smolt production estimates. Reduced exploitation associated primarily with decreased gillnet effort levels has also been a substantial factor. Fishing time during recent fall openings in District 111 has been limited to protect the Taku River chum stock, which has declined sharply from historical levels. Limited fishing time, combined with a lower number of participating vessels in recent years, has substantially reduced the exploitation rate of the gillnet fishery on the coho salmon stock. At the same time, the ability of the Canadian fishery to harvest Taku coho salmon within the river has been limited in most years by fall weather and other logistical and economic limitations associated with a remote fishing area.

The Chilkat River has produced nearly as many returning coho salmon as the Taku River, on average. Mark-recapture estimates for 4 years (1991, 1998, 2002 and 2003) were used to calibrate a standardized peak survey count in spawning areas. Recent total escapement estimates ranging from 64,500–205,400 in 2000–2005 (Table 3.2) met or exceeded the goal range of 30,000–70,000 spawners recommended by Ericksen and Fleischman (*in prep*).

SITKA AREA STOCKS

Ford Arm Lake is the only indicator stock in the Sitka area that has a long-term escapement database and an established *biological escapement goal* (Figure 3.5; Table 3.3). This stock is available along the coast from early July through early September and is harvested intensively by local directed commercial troll and marine sport fisheries, and incidentally to pink salmon in the Khaz Bay seine fishery. The goal range of 1,300–2,900 spawners has been achieved in 12 years and exceeded in 10 years during the 22-year history of the project (Figure 3.5). The goal has been exceeded more often since 1992.

Escapement to Black River, located north of Ford Arm Lake, has been surveyed once annually by helicopter since 1984. Escapement counts in this system were relatively low during 1986 to 1989, ranging from 181 to 312 spawners, but increased to a range from 690 to 1,965 spawners during 1990–2003. The 2004 count decreased again to 380 spawners.

The sum of peak escapement survey counts for five small streams near Sitka trended downward in the late 1980s but increased sharply in the early 1990s (Tables 3.1 and 3.3, Figure 3.5). The counts declined again from 1997 to 2000 before increasing in 2001-2004. Shaul and Tydingco (*in prep*) recommend a goal of 400-800 spawners for the aggregate count in the five streams based on an analysis that assumes productivity (smolts per spawner at *maximum sustained yield*) for Sitka Sound stocks to be average for coho stocks that have been studied. Their recommended goal has been achieved in every year except one (1987) and has been exceeded in 9 of the 10 most recent years.

SOUTHERN SOUTHEAST STOCKS

Hugh Smith Lake is the only full indicator stock in southern Southeast that has a long-term data series and an established escapement goal (Tables 3.1 and 3.4; Figure 3.6). However, Chuck Creek on the southern outside coast was recently added as a full indicator stock (McCurdy 2005 and *in prep*). Three total escapement counts for Chuck Creek from the 1980s (Shaul et al. 1991) are available for comparison with recent counts in 2001–2004.

Over the past 23 years, the escapement goal range of 500 to 1,100 spawners in Hugh Smith Lake (Clark et al. 1994) has been achieved nine times (Table 3.1; Figure 3.5). Escapements have been below the range only once (1989) and above it 13 times.

The Ketchikan area survey index of peak helicopter counts for 14 streams has followed a generally upward trend since 1987 with three consecutive counts above 10,000 spawners during 2001-2003 followed by a slightly lower count of 9,904 spawners in 2004 (Tables 3.1 and 3.4, Figure 3.5). Shaul and Tydingco (*in prep*) recommend a goal range of 4,250 to 8,500 spawners. During 1987–2004, escapements have fallen short of the proposed range once, within the range nine times and above the range eight times.

Weir counts at Chuck Creek, on the outer coast of southern Southeast, totaled 1,350 spawners in 2001 and 2,189 spawners in 2002, but declined to 614 spawners in 2003 and 606 spawners in 2004 (Table 3.1). Counts from 1982 to 1985 ranged from 956 to 1,238 spawners (Shaul et al. 1991). While recent escapements have been quite variable, average escapement in 2001–2004 (1,190 spawners) was similar to the average for 1982, 1983 and 1985 (1,070 spawners).

YAKUTAT STOCKS

Yakutat stocks are harvested primarily in commercial set gillnet and sport fisheries that target runs to discrete systems, but trollers fishing on mixed stocks off the coast account for some of the catch. *Biological escapement goals* exist for seven stocks in this area (Clark and Clark 1994), but comparable peak escapement surveys have been conducted relatively consistently in recent years on only three systems, the Lost, Situk, and Tsiu Rivers.

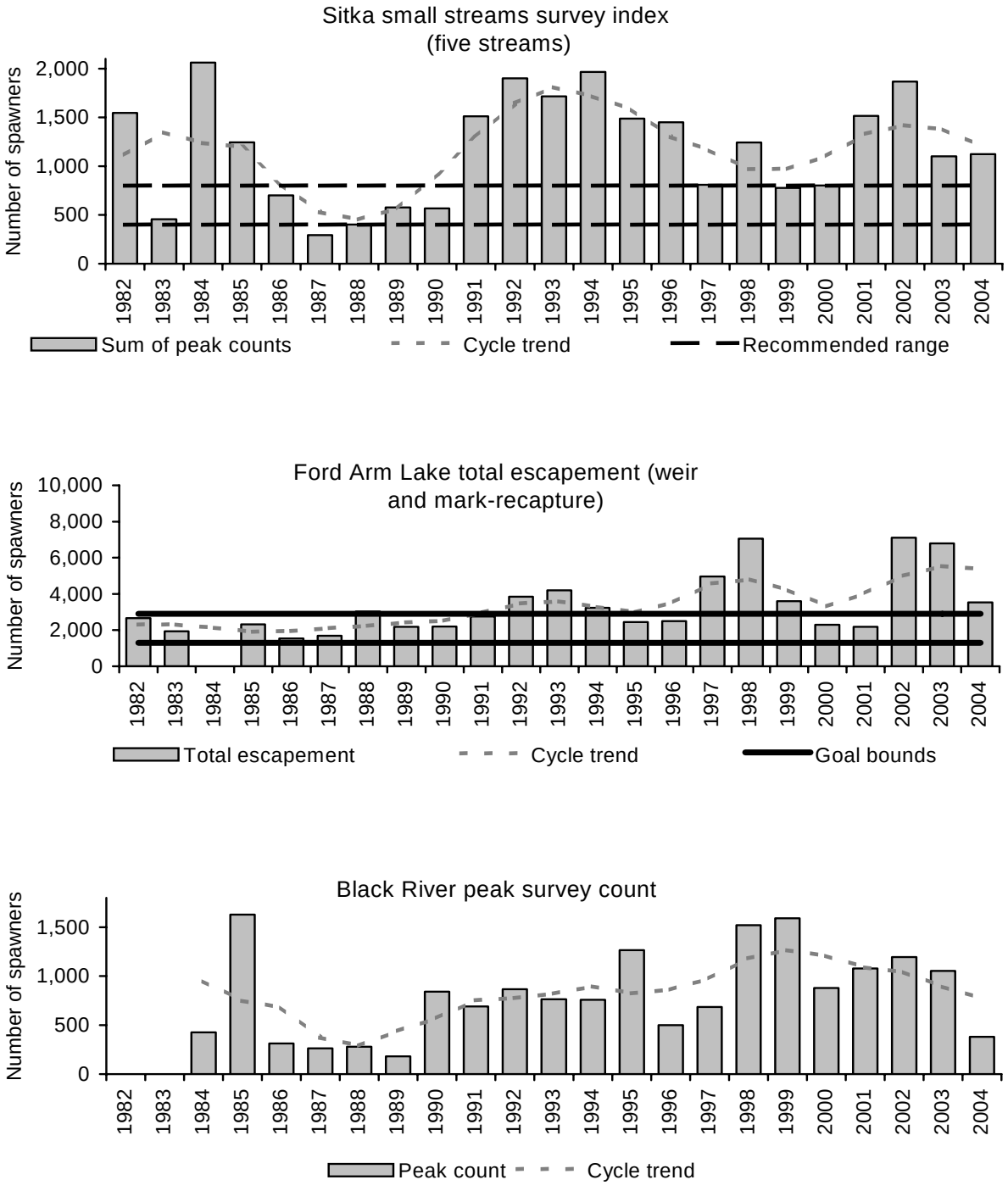

Figure 3.5–Coho salmon escapement estimates and indexes for streams in the Sitka area (District 113) and 3½-year moving average "cycle" trends.

Table 3.3–Peak counts of coho salmon in the Sitka escapement survey index (sum of five streams), mark-recapture estimates of the Nakwasina River escapement, a helicopter survey count of the Black River escapement, and a combination of weir counts and mark-recapture estimates of the Ford Arm Lake escapement.[a]

Year	Starrigavan Creek	Sinitsin Creek	St. John's Creek	Nakwasina River	Eagle River	Sitka survey index	Nakwasina River m/r estimate	Black R. survey count	Ford Arm Lake (weir- m/r)
1982	317	46	***116***	***580***	***486***	1,545			2,662
1983	45	31	20	217	***144***	457			1,938
1984	385	160	154	715	***649***	2,063		425	
1985	193	144	109	408	***392***	1,246		1,628	2,324
1986	57	***72***	***53***	275	245	702		312	1,546
1987	36	21	***22***	47	167	293		262	1,694
1988	45	56	71	104	***127***	403		280	3,028
1989	101	76	89	129	***181***	576		181	2,177
1990	39	80	38	195	214	566		842	2,190
1991	142	186	107	621	454	1,510		690	2,761
1992	241	265	110	654	629	1,899		866	3,847
1993	256	213	90	***644***	513	1,716		764	4,202
1994	304	313	227	404	717	1,965		758	3,228
1995	274	152	99	626	336	1,487		1,265	2,445
1996	59	150	201	553	488	1,451		385	2,500
1997	55	90	68	300	296	809		686	4,965
1998	123	109	57	653	300	1,242		1,520	7,049
1999	167	48	25	291	***245***	776		1,590	3,598
2000	144	62	30	459	108	803	2,000	880	2,287
2001	133	132	80	753	417	1,515	2,992	1,080	2,178
2002	227	169	100	713	659	1,868	3,141	1,194	7,109
2003	95	102	91	440	373	1,101	2,063	1,055	6,789
2004	143	112	79	399	391	1,124	3,867	380	3,539
Average	156	121	89	443	371	1,179	2,813	812	3,366

[a] Total index is the sum of counts and interpolated values. Interpolated values are shown in shaded bold italic print.

Although the data series starts in 1972, the quality and comparability of peak survey counts in the Yakutat area are somewhat lower than other areas. Most aerial and foot surveys on these systems have been conducted early in the run to support inseason management of the set gillnet fisheries.

Utility of the peak survey counts in assessing historical escapement is limited by decreasing survey effort near the peak of spawner abundance at the end of the fishery, and by frequently deteriorating weather conditions after mid-September. Survey effort on these systems declined from 1995 to 2000, but has improved in 2001–2004, although a peak count was not obtained for the Tsiu River in 2004. Escapement goals have been attained in most years (Table 3.5; Figure 3.7).

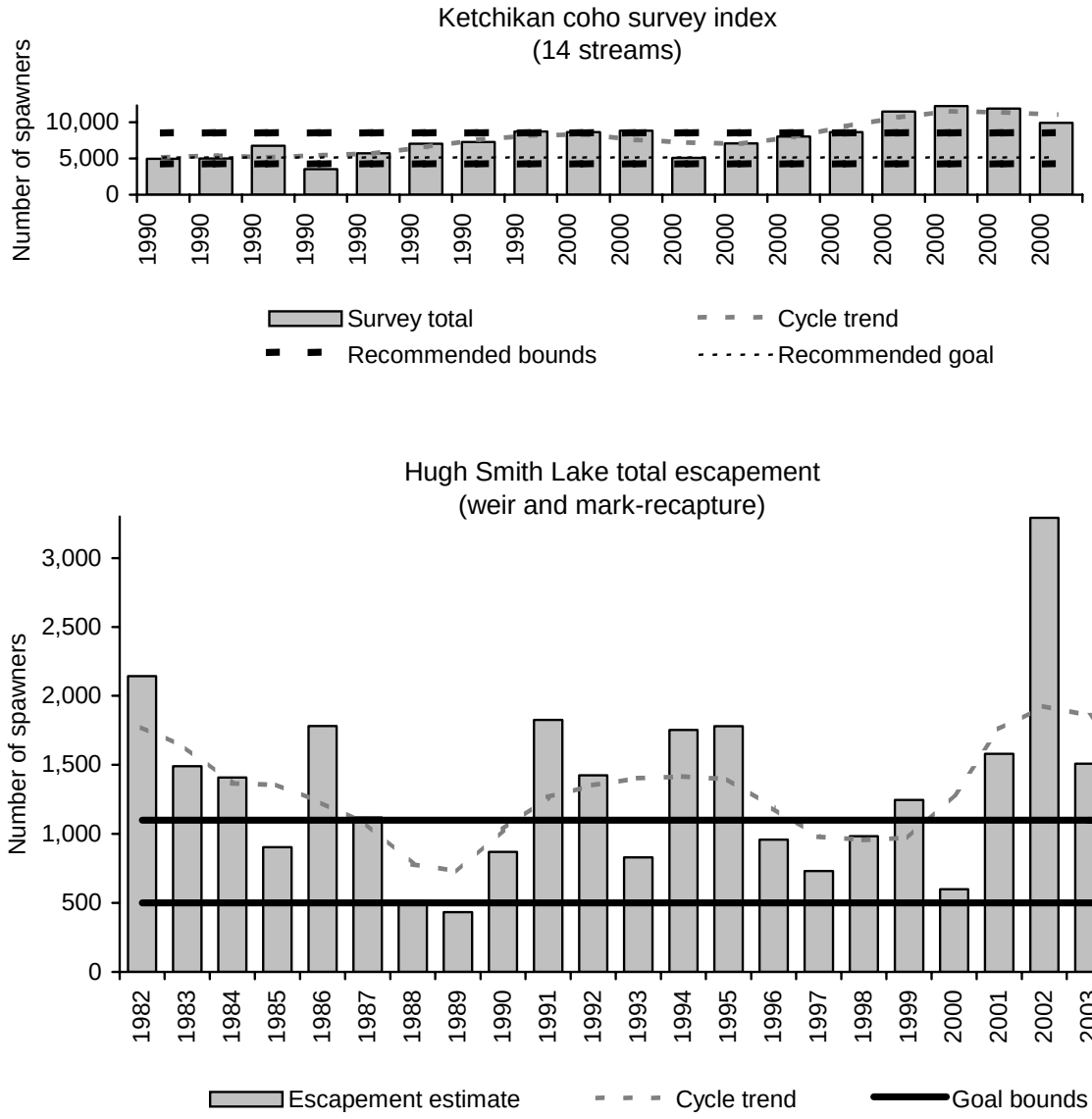

Figure 3.6–Sum of peak coho salmon escapement survey counts for 14 streams in the Ketchikan area (top figure) and coho salmon escapement counts and estimates for Hugh Smith Lake (bottom figure). Also shown are 3 1/2 year "cycle" trends, the current escapement goal for Hugh Smith Lake, and a recommended goal for Ketchikan surveyed streams (4,250–8,500 spawners).

Table 3.4–Peak coho salmon survey counts for 14 streams in the Ketchikan area and total adult coho salmon escapement to Hugh Smith Lake from 1987 to 2004. Combined survey count is the sum of counts and interpolated values. Interpolated values are show in shaded bold italic.

Year	Herman Creek	Grant Creek	Eulachon River	Klahini River	Indian River	Barrier Creek	King Creek	Choca Creek
1987	92	***88***	154	***62***	***387***	***98***	***304***	***145***
1988	72	150	205	20	300	50	175	150
1989	75	101	290	15	925	450	510	200
1990	150	30	235	150	***282***	***72***	35	***105***
1991	245	50	285	50	550	100	300	220
1992	115	270	860	90	675	100	250	150
1993	90	175	460	50	475	325	110	300
1994	265	220	755	200	560	175	325	225
1995	250	94	435	165	600	220	415	180
1996	94	92	383	40	570	230	457	220
1997	75	***85***	420	60	***371***	***94***	***292***	175
1998	94	130	460	120	304	50	411	190
1999	75	127	657	150	356	25	627	225
2000	135	94	600	110	380	72	620	180
2001	80	110	929	151	1,140	***212***	891	450
2002	88	138	1,105	20	940	70	700	220
2003	242	***197***	875	39	690	57	1,140	380
2004	150	230	801	170	935	250	640	180
Average	133	132	551	92	580	147	456	216

Year	Carroll River	Blossom River	Keta River	Marten River	Humpback Creek	Tombstone River	Combined survey count	Hugh Smith Lake (weir & m/r)
1987	180	700	800	740	650	532	4,933	1,118
1988	193	790	850	600	52	1,400	5,007	513
1989	70	1,000	650	1,175	350	950	6,761	433
1990	***139***	800	550	575	135	275	3,533	870
1991	375	725	800	575	671	775	5,721	1,826
1992	360	650	627	1,285	550	1,035	7,017	1,426
1993	310	850	725	1,525	600	1,275	7,270	830
1994	475	775	1,100	2,205	560	850	8,690	1,753
1995	400	800	1,155	1,385	82	2,446	8,627	1,781
1996	240	829	1,506	1,924	440	1,806	8,831	958
1997	140	1,143	571	759	32	847	5,063	732
1998	***255***	1,004	1,169	1,961	256	666	7,070	983
1999	425	598	1,895	1,518	520	840	8,038	1,246
2000	275	1,354	1,619	1,421	102	1,672	8,634	600
2001	173	1,561	***1,612***	1,956	506	***1,704***	11,475	1,580
2002	270	1,359	1,368	2,302	2,004	1,639	12,223	3,291
2003	***427***	1,940	1,934	1,980	214	1,745	11,859	1,510
2004	455	1,005	1,200	1,835	1,230	823	9,904	840
Average	287	994	1,118	1,429	497	1,182	7,814	1,238

SMOLT PRODUCTION

Smolt production estimates are available for 10 years or more for four systems while pre-smolt estimates in the summer prior to smolt emigration are available for Ford Arm Lake (Table 3.6). Estimates are listed by adult return year for the smolt emigration in the previous year.

A long-term downward trend in Auke Creek smolt production noted by Shaul et al. (2004) continued during the two most recent years (Table 3.6). A record low migration of 3,567 smolts was associated with the 2004 adult return, followed by 4,291 smolts for 2005. These numbers were substantially lower than decade averages of 7,323 smolts in the 1980s and 6,292 smolts in the 1990s as well as the more recent 2000–2003 average of 4,948 smolts. A robust trend (Geiger and Zhang 2002) indicates a linear rate of decline of about 1.5% per year or 38.4% (2,956 smolts) over the entire 26-year period. The decline in Auke Creek smolt production has occurred despite relatively level brood year escapements that have trended above the *biological escapement goal* (Figure 3.4, Table 3.2).

The decline in Auke Creek smolt production stands in contrast to other monitored wild coho salmon producing systems in northern Southeast. Although the two most recent smolt migrations from the Berners River were below average (Table 3.6), there is no apparent trend in smolt production from that system. The most recent estimate of 185,125 smolts that migrated from the Berners River in 2003, and returned as adults in 2004, was the median smolt estimate for the 15-year period of record (1990–2004).

In the Taku River, meanwhile, the two highest smolt production estimates on record of between 2.9-3.0 million smolts (Table 3.6) occurred in 2002 and 2003 (2003 and 2004 adult returns). Taku River smolt estimates declined from 1.1–1.5 million during 1992–1995 to 0.8–1.0 million in 1996–1998 before approximately tripling to 2.3–3.0 million in 2002–2004. The reason for the recent trend in estimates is unclear. However, beginning in 2000, Jones et al. (*in prep*) found that use of the simple Chapman's estimate produced smolt estimates that were biased low (~12% over five years) due to size selectivity in smolt tagging and applied a stratified estimate to account for this bias, accordingly.

Shaul et al. (2004) noted an upward trend in pre-smolt production in the Ford Arm Lake system and speculated that it may have resulted from increased carcass nutrient input. Estimated midsummer pre-smolt abundance in the Ford Arm Lake system trended upward from an average of 62,000 pre-smolts for returns in the 1980s to 82,100 in the 1990s, and 90,300 from 2000 to 2002. Estimates associated with the 2003 and 2004 returns of 77,100 pre-smolts and 101,600 pre-smolts, respectively, (Table 3.6) have maintained the recent pattern of higher average production compared with the 1980s and early 1990s.

Smolt production from Hugh Smith Lake has shown no evident long-term trend away from long-term average production of about 31,200 smolts during 1984–2004 (Table 3.6).

MARINE SURVIVAL

Marine survival rates for indicator stocks increased in the early 1980s and reached a peak in the early to mid-1990s before declining to more moderate levels from 1995 to 2004 (Table 3.7, Figure 3.8). The recent pattern in marine survival rates is also reflected in the wild coho salmon harvest in commercial fisheries (Figure 3.1).

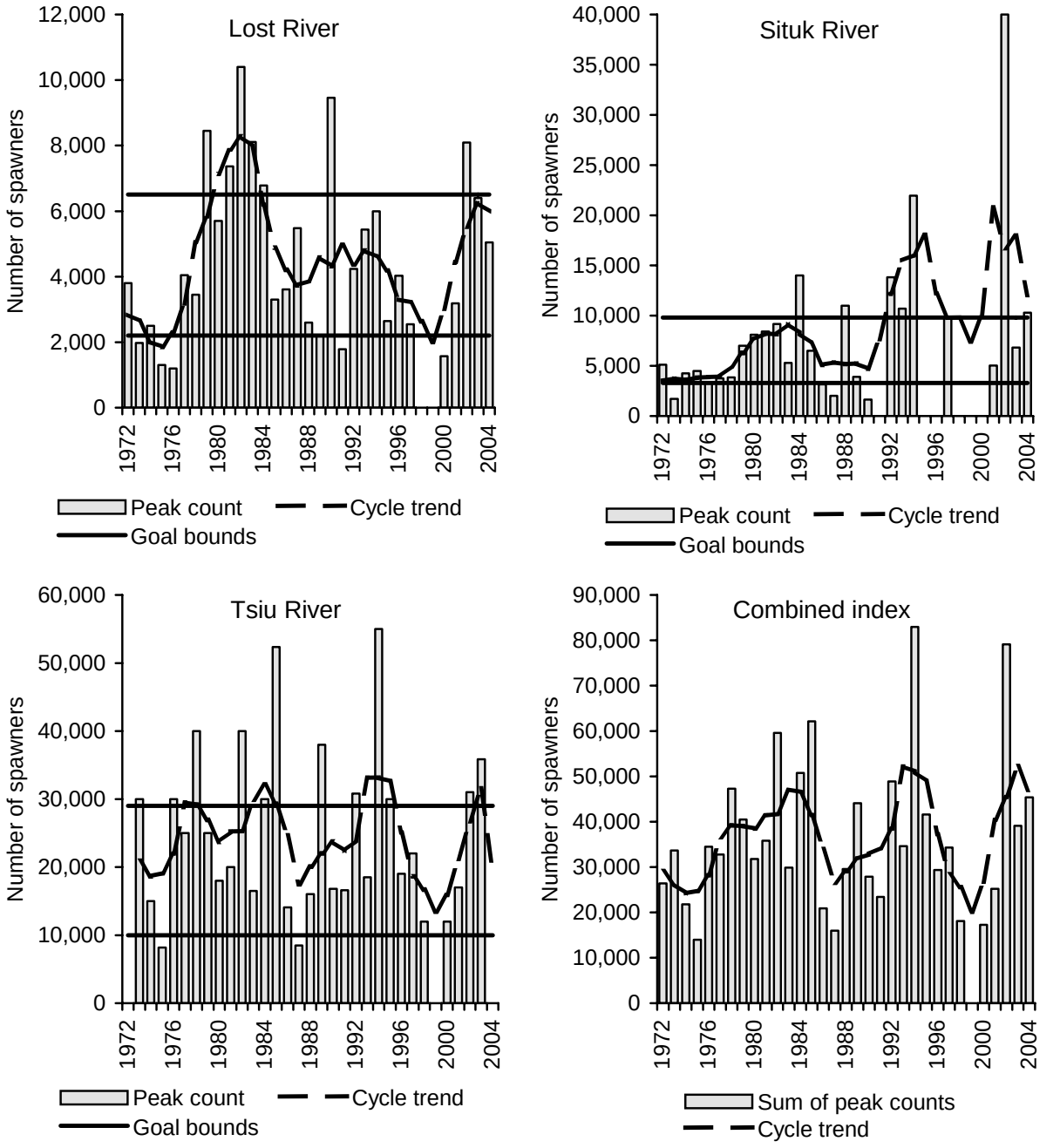

Figure 3.7–Peak coho salmon escapement survey counts for three systems in the Yakutat area and the combined count for all three systems from 1972 to 2004, with 3½-year moving average "cycle" trends. The total index includes interpolations for systems without counts in all years except 1999 (see Escapement Indicators section for a description of the method used).

Table 3.5–Yakutat area coho salmon peak escapement survey counts from 1972 to 2004.

Year	Lost River	Situk River	Tsiu River	Total count[a]
1972	3,800	5,100		26,361
1973	1,978	1,719	30,000	33,697
1974	2,500	4,260	15,000	21,760
1975	1,300	4,500	8,150	13,950
1976	1,200	3,280	30,000	34,480
1977	4,050	3,750	25,000	32,800
1978	3,450	3,850	40,000	47,300
1979	8,450	7,000	25,000	40,450
1980	5,700	8,100	18,000	31,800
1981	7,363	8,430	20,000	35,793
1982	10,400	9,180	40,000	59,580
1983	8,110	5,300	16,500	29,910
1984	6,780	14,000	30,000	50,780
1985	3,300	6,490	52,350	62,140
1986	3,610	3,162	14,100	20,872
1987	5,482	2,000	8,500	15,982
1988	2,600	11,000	16,000	29,600
1989	2,190	3,900	38,000	44,090
1990	9,460	1,630	16,800	27,890
1991	1,786		16,600	23,441
1992	4,235	13,820	30,800	48,855
1993	5,436	10,703	18,500	34,639
1994	6,000	21,960	55,000	82,960
1995	2,642		30,000	41,616
1996	4,030		19,000	29,361
1997	2,550	9,780	22,000	34,330
1998			12,000	18,116
1999				
2000	1,572		12,000	17,303
2001	3,190	5,030	17,000	25,220
2002	8,093	40,000	31,000	79,093
2003	6,396	6,814	35,850	39,127
2004	5,047	10,284		45,410
Average	4,603	8,335	24,772	36,835
Lower bound	2,200	3,300	10,000	
Upper bound	6,500	9,800	29,000	

[a] Total includes interpolations for systems without counts (see Escapement Indicators section for a description of the method used).

Table 3.6–Total coho smolt and pre-smolt production estimates for five wild coho salmon producing systems in Southeast Alaska by age .1 return year, 1980–2005.

Return Year	Auke Creek smolts	Berners River smolts	Taku River smolts	Ford Arm Lake pre-smolts	Hugh Smith Lake smolts
1980	8,789				
1981	10,714				
1982	6,967			78,682	
1983	6,849			65,186	
1984	6,901				51,789
1985	6,838			38,509	32,104
1986	5,852			46,422	23,499
1987	5,617			73,272	21,878
1988	7,014			88,649	36,218
1989	7,685			43,354	23,336
1990	7,011	163,998		55,803	26,620
1991	5,137	141,291		56,284	32,925
1992	5,690	187,688	1,080,551	61,724	23,326
1993	6,596	326,312	1,510,032	57,401	32,853
1994	8,647	255,519	1,475,874	83,686	48,433
1995	7,495	181,503	1,525,330	134,640	49,288
1996	4,884	194,019	986,489	91,843	22,413
1997	3,934	133,629	759,763	66,528	32,294
1998	6,111	139,959	853,662	80,567	37,898
1999	7,420	252,168	1,184,195	132,607	29,830
2000	5,233	181,271	1,387,399	62,444	19,902
2001	4,969	268,777	1,720,387	106,409	23,346
2002	5,980	264,599	2,292,949	101,860	36,497
2003	3,611	151,980	2,988,349	77,081	26,897
2004	3,567	185,125	2,941,525	101,579	23,074
2005	4,291	[a]	[a]	[a]	[a]
Average	6,300	201,856	1,592,808	77,479	31,163

[a] Estimates for these systems are unavailable pending mark-recovery sampling of returning adults in 2005.

Survival rates in the most recent 10-year period have followed relatively stable trends for most stocks at historically favorable average rates of 22% for Auke Creek, 15% for Berners River, 10% for the Taku River and 12% for Hugh Smith Lake. The reason for highly variable average survival rates among closely situated systems is unclear. Variation in smolt size among systems may play a role.

Auke Creek smolts are very large, for example. On the other hand, a high percentage of smolts from Auke Creek return as jacks, which are not counted in these survival calculations. Shaul et al. (2004) noted an inverse relationship between marine survival and stock size not only in the northern inside area (Auke Creek, Berners River, Taku River) but in the southern boundary area as well (Hugh Smith Lake, Lachmach River and Nass River) based on estimates reported in by the Joint Northern Boundary Technical Committee (2002).

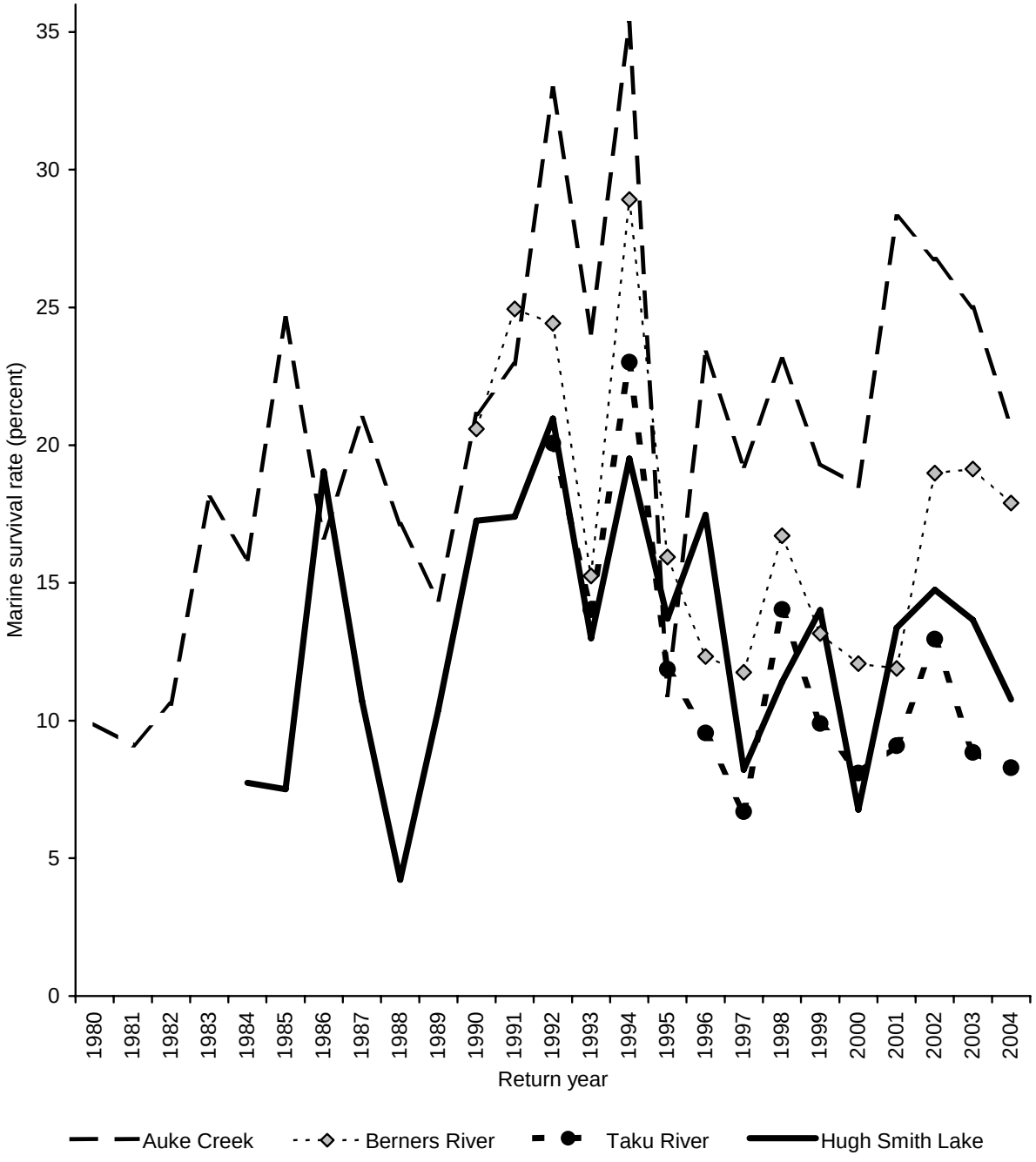

Figure 3.8–Estimated marine survival rate for coho salmon smolts from four indicator stocks in Southeast Alaska from 1980 to 2004.

Table 3.7–Estimated survival rate (percent) of coho salmon smolts and pre-smolts from five wild Southeast Alaska indicator stocks from the time of tagging until return to the fisheries.

Return Year	Auke Creek smolts	Berners River smolts	Taku River smolts	Ford Arm Lake pre-smolts	Hugh Smith Lake smolts
1980	9.9				
1981	9.1				
1982	10.6			6.0	
1983	18.1			9.5	
1984	15.9				7.7
1985	24.6			12.4	7.5
1986	16.6			8.8	19.0
1987	21.0			4.4	10.7
1988	17.1			6.7	4.2
1989	14.4			14.2	10.4
1990	21.1	20.6		9.5	17.3
1991	23.0	24.9		10.7	17.4
1992	33.0	24.4	20.1	15.1	21.0
1993	24.1	15.3	14.0	22.1	13.0
1994	35.3	28.9	23.0	13.7	19.5
1995	10.9	15.9	11.9	5.6	13.7
1996	23.4	12.3	9.6	6.5	17.5
1997	19.2	11.8	6.7	15.4	8.2
1998	23.1	16.7	14.0	19.9	11.4
1999	19.3	13.2	9.9	7.5	14.0
2000	18.5	12.1	8.1	12.9	6.8
2001	28.3	11.9	9.1	8.1	13.4
2002	26.8	19.0	13.0	14.8	14.7
2003	25.0	19.1	8.8	17.1	13.7
2004	21.0	17.9	8.3	11.9	10.8
Average	20.4	17.6	12.3	11.5	13.1

Survival of Ford Arm Lake pre-smolts has averaged a relatively high 11% (range 4–22%) over a 22-year period despite exposure to approximately 10 months of additional freshwater mortality after tagging before entering the marine environment. Survival of the Ford Arm stock improved from an average of 9% during 1982–1989 to 13% in the 1990s and remained at a 13% average during 2000–2004.

TOTAL STOCK ABUNDANCE

Total return abundance of the stocks, including catch and escapement, is the product of smolt production and marine survival. For the full indicator stocks, estimates of total escapement and harvest are shown in Tables 3.8–3.14 and Figures 3.9–3.10.

The three longest studied indicator stocks in inside areas of Southeast show similar patterns in abundance since the early 1980s. The Auke Creek, Berners River, and Hugh Smith Lake stocks all show relatively level long-term trends, with a period of high abundance in the early 1990s and

a spectacular peak in 1994 (Figure 3.9, Tables 3.8, 3.9 and 3.11) that coincided with a similar peak in the commercial catch of wild coho salmon (Figure 3.1). Average returns to Hugh Smith Lake increased from about 3,400 fish in 1982–1989 to 5,100 fish in the 1990s but declined again to 3,200 fish in 2000–2004. However, escapements were strong during the latter period and the biological goal range of 500–1,100 spawners was met or exceeded each year. The 2002 escapement of nearly 3,300 spawners was by far the largest on record.

Estimated returns to the Taku River above Canyon Island increased substantially in 2002–2004 to levels approximating the 1992–1994 peak (Figure 3.10). However, exploitation rates were low and escapements increased far above the escapement threshold, reaching a peak of 219,400 spawners in 2002. The recent increase in abundance of Taku River coho salmon appears attributed to increased smolt production (Table 3.6) rather than an increase in marine survival (Table 3.7).

The Ford Arm Lake stock on the outer coast has followed an upward trend best described by a 5.2% exponential rate of increase in total adult run size leading to a tripling of abundance from 1982 to 2004 (Table 3.10). The increase in total run size has resulted from increases in both pre-smolt production and survival from pre-smolt to adult.

Return estimates for other indicator stocks, including Chilkat River (Table 3.13), Nakwasina River and Chuck Creek (Table 3.14) are too limited to infer trends. Recent estimated Chuck Creek returns of 1,488 adults in 2003 and 1,586 in 2004 were smaller than 1982–1985 returns averaging 3,000 adults (range 2,407–3,837). However, escapement counts of 1,350 in 2001 and 2,189 in 2002 suggest runs were strong in some recent years.

EXPLOITATION RATES

Most Southeast Alaska coho salmon stocks accumulate substantial exploitation rates in mixed-stock fisheries. Some inside stocks run a gauntlet of fisheries, from troll and marine sport fisheries along the outer coast, through net, sport and troll fisheries in corridor areas, and through intensive inside gillnet fisheries concentrated near some estuaries. In some cases, there are significant freshwater sport and subsistence harvests as well.

Shaul et al. (2004) pointed to reduced fishing effort and resultant exploitation rates after 2000 because of market and price pressures on the fisheries. However, that pattern appeared to be reversed in 2004 (Tables 3.15–3.20; Figures 3.11 and 3.12) in apparent response to improved prices, particularly in the troll fishery.

The Auke Creek stock has been exploited at a relatively low average rate of 41% (range 20% to 55%) during 1980 to 2004, owing mainly to lack of intensive net fishing in its migratory pathway during the fall (Figures 3.11 and 3.12; Table 3.15). The troll fishery has accounted for the majority of the harvest, exploiting the stock at an average rate of 30% (range 12% to 48%) with less than 5% each attributed to seine, gillnet, and sport fisheries. During 2000–2003, total exploitation rate estimate for this stock were consistently below average, ranging from 26–38%, but increased to 44% in 2004, the highest estimate since 1996 (Table 3.15). The troll fishery exploitation rate increased to 27% in 2004 from 18% in 2002 and 23% in 2003.

Table 3.8–Estimated harvest by gear type, escapement, and total run of coho salmon returning to Auke Creek from 1980 to 2004.

		Number of fish						
Year	Fishery sample size[a]	Troll	Seine	Drift gillnet	Sport	Total catch	Escapement	Total return
1980	15	117	0	29	24	170	698	868
1981	70	280	0	31	19	330	646	976
1982	45	149	117	24	2	292	447	739
1983	129	385	10	28	122	545	694	1,239
1984	124	372	8	13	51	444	651	1,095
1985	177	594	3	71	73	741	942	1,683
1986	110	421	2	60	37	520	454	974
1987	145	438	2	48	23	511	668	1,179
1988	145	306	12	72	55	445	756	1,201
1989	182	533	7	15	49	604	502	1,106
1990	168	635	15	57	78	785	697	1,482
1991	47	200	8	152	11	371	808	1,179
1992	53	603	10	196	46	855	1,020	1,875
1993	169	611	8	92	19	730	859	1,589
1994	330	1,064	224	218	112	1,618	1,437	3,055
1995	82	264	5	65	26	360	460	820
1996	160	446	11	133	36	626	515	1,141
1997	43	94	4	0	50	148	609	757
1998	157	437	17	43	54	551	862	1,413
1999	160	485	5	58	42	590	845	1,435
2000	103	228	6	23	29	286	683	969
2001	149	435	10	41	55	541	865	1,406
2002	125	288	8	77	51	424	1,176	1,600
2003	97	211	4	59	45	319	585	904
2004	62	199	47	71	15	332	416	748
Average		400	21	67	46	534	745	1,279

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

Troll fishery exploitation rates for the Berners River stock showed a similar pattern, increasing to 32% in 2004 from 17% in 2002 and 24% in 2003 (Figures 3.11 and 3.12; Table 3.16). The 2004 total exploitation rate estimate for the Berners River stock of 56% was the second highest since 2000, but lower than 65% in 2003 when the run was heavily harvested inside Berners Bay by the Lynn Canal gillnet fishery.

Exploitation rates on the Taku River run decreased from an average of 57% (range 48–72%) in 1992–1999 to 36% (range 26–46%) in 2000–2004 (Table 3.19). Marine sport and purse seine exploitation rates remained relatively unchanged, but exploitation by the primary harvesting fisheries (troll and drift gillnet) declined sharply. The average troll exploitation rate declined from 26% to 18% while the average gillnet exploitation rate decreased even more from 21% to 9%. Market conditions are believed to have played a role, particularly in the decline in gillnet

Table 3.9–Estimated harvest by gear type, escapement and total run of coho salmon returning to the Berners River from 1982 to 2004.

		Number of fish								
Year	Fishery sample size[a]	Troll	Seine	Drift gillnet	Sport	B.C. net	Cost recovery	Total catch	Escapement	Total run
1982	48	12,887	0	10,568	0	0	0	23,455	7,505	30,960
1983	125	17,153	0	6,978	65	0	0	24,196	9,840	34,036
1984									2,825	
1985	93	10,865	198	7,015	0	0	0	18,078	6,169	24,247
1986	157	13,560	0	8,928	395	0	0	22,883	1,752	24,635
1987	53	7,448	0	3,301	48	0	0	10,797	3,260	14,057
1988	102	5,926	181	6,141	0	0	0	12,248	2,724	14,972
1989	58	10,515	0	1,664	0	0	0	12,179	7,509	19,688
1990	471	14,851	141	7,352	369	0	0	22,713	11,050	33,763
1991	1,025	6,417	579	16,519	117	0	0	23,632	11,530	35,162
1992	701	15,337	344	14,677	192	0	0	30,550	15,300	45,850
1993	1,496	19,353	192	14,239	140	0	0	33,924	15,670	49,594
1994	2,647	27,319	1,686	27,907	891	5	0	57,808	15,920	73,728
1995	1,384	8,847	22	14,869	117	0	0	23,855	4,945	28,800
1996	601	10,524	380	6,434	412	0	0	17,750	6,050	23,800
1997	312	2,454	282	2,477	179	0	0	5,392	10,050	15,442
1998	613	10,427	435	5,716	380	0	0	16,958	6,802	23,760
1999	948	12,877	208	9,317	261	0	0	22,663	9,920	32,583
2000	693	5,362	145	5,296	196	0	6	11,005	10,650	21,655
2001	748	8,854	195	3,499	123	0	0	12,671	19,290	31,961
2002	788	8,671	228	13,014	471	0	0	22,384	27,700	50,084
2003	1,326	6,866	247	11,302	455	0	0	18,870	10,110	28,980
2004	756	10,608	90	7,301	217	0	0	18,216	14,450	32,666
Average		11,233	252	9,296	229	0	0	21,110	10,044	31,383

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

exploitation, which coincided with lower participation in the District 111 fishery. Also, weekly gillnet openings in District 111 were limited during much of the period to conserve the fall Taku River chum stock.

Troll fishery exploitation rate estimates for the Chilkat River during 2000–2005 averaged higher than estimates for the Taku River (25% compared with 18%) but displayed a similar pattern with the highest estimate in 2004 (Table 3.20). The estimate of 43% for the Chilkat River in 2004 was substantially higher than 2000–2003 average of 20% (range 18–24%). Chilkat River fish were also exploited more heavily by the drift gillnet fishery at rates ranging from 9–18% (average 13%) during 2000–2004 compared with 10% (range 7–12%) for the Taku run. The total exploitation rate estimate of 67% for the Chilkat River in 2004 was substantially higher than 2000–2003 estimates ranging from 32–39%.

The Ford Arm Lake stock has been harvested at moderate to high exploitation rates, primarily in the region's commercial troll fishery, which is most intensive in waters near this system. The

Table 3.10–Estimated harvest by gear type, escapement, and total run of coho salmon returning to Ford Lake from 1982 to 2004.

		Number of fish							
Year	Fishery sample size[a]	Alaska troll	Seine	Drift gillnet	Sport	Canadian troll	Total catch	Escapement	Total run
1982	38	1,948	106	0	0	0	2,054	2,662	4,716
1983	93	3,344	912	0	0	0	4,256	1,938	6,194
1984									
1985	49	2,438	0	0	0	0	2,438	2,324	4,762
1986	87	2,500	62	0	0	0	2,562	1,546	4,108
1987	71	1,456	79	0	0	0	1,535	1,694	3,229
1988	151	2,857	46	0	0	30	2,933	3,028	5,961
1989	221	3,777	185	0	0	0	3,962	2,177	6,139
1990	174	2,979	108	0	0	0	3,087	2,190	5,277
1991	193	3,208	44	10	0	0	3,262	2,761	6,023
1992	199	5,252	208	0	0	0	5,460	3,847	9,307
1993	349	7,847	443	0	201	0	8,491	4,202	12,693
1994	236	6,918	1,234	0	112	0	8,264	3,228	11,492
1995	91	3,577	1,468	0	0	0	5,045	2,445	7,490
1996	64	3,148	0	0	332	0	3,480	2,500	5,980
1997	241	4,883	0	0	373	0	5,256	4,965	10,221
1998	315	7,835	435	20	679	0	8,969	7,049	16,018
1999	145	5,872	66	0	441	0	6,379	3,598	9,977
2000	193	4,603	926	13	221	0	5,763	2,287	8,050
2001	131	5,818	115	0	480	0	6,412	2,178	8,590
2002	246	5,751	1,260	0	998	0	8,009	7,109	15,118
2003	225	4,154	504	0	1,770	0	6,428	6,789	13,217
2004	153	7,722	523	0	319	0	8,564	3,539	12,103
Average		4,449	397	2	269	1	5,119	3,366	8,485

[a]Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

exploitation rate by the troll fishery has averaged 53% since 1982 (Figure 3.11; Table 3.17) while intermittent seine harvests and increasing marine sport fishing have brought the long-term average exploitation rate by all fisheries up to 60%. The troll fishery exploitation rate dipped to a record low estimate of 31% in 2003, but the decrease was offset in large part by an exceptionally high marine sport exploitation rate of 13%, representing a harvest of 1,770 Ford Arm coho salmon based on recovery of 59 tags in the Sitka marine sport fishery. However, the 2003 all-gear exploitation rate of 49% was below the long-term average of 60%. The 2004 all-gear exploitation rate estimate of 71% was well above average and was primarily attributed to the high troll fishery exploitation rate of 64% with lower exploitation rates by the purse seine fishery (4%) and marine sport fishery (3%). Although the total exploitation rate dipped in 2003, the 2000–2004 average rate of 64% actually represented an increase compared with 55% in the 1980s and 61% in the 1990s. Over time, the Ford Arm Lake stock not only increased dramatically in abundance (Figure 3.9), it became more heavily exploited during a period when exploitation rates on most other stocks declined from 1990s levels. The stock forages in coastal waters throughout the summer and is, therefore, substantially more available to intensive hook-and-line fisheries in the vicinity of Sitka and Pelican compared with more migratory stocks. It has become one of the most heavily fished stocks by the expanding sport charter fishery with a

Table 3.11–Estimated harvest by gear type, escapement, and total run of coho salmon returning to Hugh Smith Lake from 1982 to 2004.

		Number of fish										
Year	Fishery sample size[a]	Alaska troll	Alaska seine	Alaska gillnet	Alaska trap	Alaska sport	B.C troll	B.C. net	B.C. sport	Total catch	Escapement	Total return
198	91	2,780	627	203	0	0	264	78	0	3,952	2,144	6,096
198	189	1,373	424	277	49	0	211	51	0	2,385	1,490	3,875
198	151	1,260	501	470	18	0	325	28	0	2,602	1,408	4,010
198	212	868	287	137	5	0	199	13	0	1,509	903	2,412
198	257	1,585	515	315	2	14	234	26	0	2,691	1,783	4,474
198	100	656	95	249	0	23	153	50	0	1,226	1,118	2,344
198	42	408	230	122	0	0	234	23	0	1,017	513	1,530
198	91	1,213	375	237	0	41	105	20	0	1,991	433	2,424
199	263	1,810	538	504	24	0	794	53	0	3,723	870	4,593
199	408	2,102	195	881	0	54	630	43	0	3,905	1,826	5,731
199	497	1,852	674	601	0	42	286	9	0	3,464	1,426	4,890
199	162	2,259	262	677	0	0	197	43	0	3,438	830	4,268
199	846	4,339	1,125	1,424	0	59	684	53	13	7,697	1,753	9,450
199	433	2,030	908	1,651	0	101	241	28	13	4,972	1,781	6,753
199	496	1,581	640	478	0	104	126	36	0	2,965	950	3,915
199	481	1,286	121	397	0	27	89	0	0	1,920	732	2,652
199	666	1,772	471	980	0	113	0	0	0	3,336	983	4,319
199	493	1,761	291	727	0	153	0	0	0	2,932	1,246	4,178
200	161	489	45	116	0	97	0	0	0	747	600	1,347
200	314	697	455	324	0	58	7	0	0	1,541	1,580	3,121
200	433	892	451	555	0	91	65	0	38	2,092	3,291	5,383
200	336	895	354	690	0	106	91	26	0	2,162	1,510	3,672
200	244	1,016	196	232	0	60	48	20	73	1,645	840	2,485
Average		1,518	425	532	4	50	217	26	6	2,779	1,305	4,084

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

recent 2001–2004 average estimated contribution of 892 fish (range 319–1,770 fish) to the marine sport fishery under an average exploitation rate of 7% (range 3–13%).

The Nakwasina River stock in Sitka Sound was exploited at an average estimated rate of 28% (range 19–38%) by all fisheries in 2000–2005 (Table 3.20). The troll fishery accounted for most of the catch with an average exploitation rate of 24% while the marine sport and purse seine fisheries followed with about 4% and 1%, respectively. The Nakwasina River stock appears substantially less available to the fisheries compared with the Ford Arm Lake stock located about 60 km to the north. The Ford Arm Lake stock was harvested at an average rate of 64% during the same period (52% troll, 6% seine, 6% marine sport). The two stocks are harvested mostly in the same locations but the Ford Arm Lake stock is less migratory, being present in nearly full abundance at the beginning of the summer troll fishery while the Nakwasina River stock begins entering the fishery in July but usually does not reach peak abundance until early to mid-September. Therefore, the Nakwasina River stock has less exposure to both hook and line fisheries throughout the summer and to purse seine fisheries that occur primarily in August.

Table 3.12–Estimated catch and escapement of coho salmon bound for the Taku River above Canyon Island from 1987 to 2004.

		Number of Fish							
Year	Fishery sample size[a]	Troll	Seine	Gillnet	Marine sport	Canadian inriver	Total catch	Escapement	Total return
1987						6,519		55,457	
1988						3,643		39,450	
1989						4,033		56,808	
1990						3,685		72,196	
1991						5,439		127,484	
1992	129	41,733	5,062	76,325	3,337	5,541	131,998	84,853	216,851
1993	121	61,129	2,675	31,440	2,513	4,634	102,392	109,457	211,849
1994	178	97,040	26,352	86,198	19,018	14,693	243,301	96,343	339,644
1995	201	45,042	1,853	56,820	7,857	13,738	125,310	55,710	181,020
1996	136	24,780	220	17,067	2,461	5,052	49,580	44,635	94,215
1997	66	8,823	550	1,490	4,963	2,690	18,516	32,345	50,861
1998	231	28,827	742	19,371	4,428	5,090	58,458	61,382	119,840
1999	252	36,229	2,881	7,507	4,170	5,575	56,361	60,844	117,205
2000	221	21,090	1,577	9,935	9,552	5,447	47,601	64,700	112,301
2001	344	31,992	2,066	11,378	3,278	3,099	51,813	104,460	156,272
2002	397	39,012	3,457	24,481	7,076	3,802	77,828	219,360	297,188
2003	195	38,081	3,812	28,953	6,665	3,717	81,228	183,038	264,266
2004	223	61,516	5,334	29,025	6,011	9,432	111,318	132,405	243,723
1992–2004 Average		41,177	4,352	30,768	6,256	6,347	88,900	96,118	185,018
1987–2004 Average		-	-	-	-	5,879	-	88,940	-

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

The Hugh Smith Lake stock is an example of a stock that traverses an extended gauntlet of mixed stock fisheries along the coast and is exposed to fisheries outside of state jurisdiction in Canada and around Annette Island. From 1982 to 1988, the Hugh Smith Lake stock was exploited at moderate rates for coho salmon, averaging 62% (Figures 3.11 and 3.12; Table 3.18). However, exploitation became markedly more intense during 1989 to 1999 at an average rate of 76% (range 68% to 82%) before decreasing sharply to 39–59% (average 51%) in 2000–2003. The primarily cause of the decrease was a decrease in the troll component. In 2004, however, the troll fishery exploitation rate increased substantially to 41% from 16–36% (average 25%) in 2000–2003 and the total exploitation rate in 2004 increased to 66%, near the long-term average of 67%. Following a period of dramatic fishery curtailment beginning in 1998, fisheries in British Columbia have begun to exploit the Hugh Smith Lake stock again. The most recent exploitation rate by British Columbia fisheries (6% in 2004) approached the pre-1998 average of 8%.

The Chuck Creek stock on the southern outside coast was exploited at a rate of 62% in 2004, compared with 59% in 2003 (Table 3.20). Based on a smaller number of tag recoveries, exploitation rate estimates from 1982–1985 were similar on average (62%; range from 49-75%) to more recent years. Most of the harvest of Chuck Creek coho salmon is taken in the troll and seine fisheries, although recent development of the sport charter fishery has resulted in significant sport exploitation rates estimated at 6% in 2003 and 5% in 2004.

ESCAPEMENT GOAL DEVELOPMENT

Biological escapement goals were established for the four long-term indicator stocks in 1994 using Ricker analysis (Clark et al. 1994). Using the same technique, Clark (1995) developed goals for the five surveyed roadside streams in the Juneau area while Clark and Clark (1994) developed escapement goals for seven streams in the Yakutat area. These *biological escapement goal* ranges are designed to maintain wild stocks at high levels of productivity, and to maintain yields near maximum. The goals represent a range of escapements that were estimated to produce 90% or more of *maximum sustained yield.*

The 1999 Pacific Salmon Treaty specifies a minimum objective for the number of coho salmon passing above Canyon Island in the Taku River. The current above-border minimum goal of 38,000 adults effectively translates to an effective sustainable escapement goal of about 35,000 spawners after projected minimal harvests in commercial, food, and test fisheries from an above-border run of that size. A *biological escapement goal* will be developed for this stock after production is realized from the extremely high escapements seen in 2002 and 2003. Including these levels of escapement in the *biological escapement goal* analysis will add needed contrast to the spawner-recruit dataset.

Over a decade of additional estimates of smolt or pre-smolt production and adult returns are available since escapement goals were developed for the main four long-term indicator stocks. However, research effort has been diverted from updating escapement goals for these systems to another problem. Shaul et al. (2004) presented information indicating that inaccurate aging of the freshwater growth period may be a serious obstacle to developing meaningful spawner-recruit relationships. A project was initiated in 1996 to evaluate and validate aging methodology for coho salmon. Recently, Berners River adults have been re-aged using several years of known-age samples as standards. A similar process is anticipated for the Hugh Smith Lake and Ford Arm Lake stocks. *Biological escapement goals* for these stocks will then be updated.

In order to improve stock assessment information on Yakutat area coho salmon stocks, ADF&G initiated an intensive research program in 2003, centered on stocks (Situk, Lost and Ahrnklin rivers) that contribute to fisheries in the Situk-Ahrnklin Lagoon. Commercial set gillnet, sport and subsistence fisheries operating in the lagoon and in the Situk River are the largest coho salmon fisheries in the Yakutat area. In 2004 and 2005 juvenile coho salmon were coded wire tagged on the three systems; tag recoveries in 2005 and 2006 will provide estimates of harvest rates and distribution. Total escapements to the systems are also being estimated to improve information on the relationship of peak survey counts to total escapement. An improved understanding of production from these systems is expected to translate into improved escapement goals for Yakutat coho salmon stocks in the future.

As a result of ADF&G's 2005 review of Southeast Alaska and Yakutat salmon escapement goals, proposed goals have been developed for several systems, including the Chilkat River and aggregates of streams that are surveyed in the Ketchikan and Sitka areas. In addition, Clark (*in prep*) revised goals for two Juneau roadside streams (Montana and Peterson Creeks) and recommended elimination of goals for the other three streams (Steep, Jordan and Switzer Creeks). Goals for three rivers in the Yakutat area (Kaliakh, East Alsek, and Akwe rivers) that are no longer consistently surveyed for coho salmon were also recommended for elimination.

Table 3.13–Estimated harvest by gear type, escapement and total run of coho salmon returning to the Chilkat River, 1987-2004.

Year	Fishery sample size[a]	Number of fish							
		Troll	Seine	Drift gillnet	Sport	Subsistence	Total catch	Escapement	Total run
1987								35,800	
1988								28,209	
1989								46,704	
1990								79,807	
1991								80,831	
1992								74,205	
1993								55,678	
1994								185,948	
1995								54,263	
1996								35,704	
1997								41,622	
1998								50,758	
1999								54,649	
2000	265	22,030	833	15,744	1,762	199	40,568	84,756	125,324
2001	251	30,624	673	13,709	2,911	126	48,043	103,958	152,001
2002	352	63,056	812	43,296	6,255	574	113,993	205,429	319,422
2003	426	51,794	1,268	26,305	6,372	494	86,233	134,340	220,573
2004	258	83,848	932	34,182	10,706	454	130,122	64,524	194,646
2000–2004 Average		50,270	904	26,647	5,601	369	83,792	118,601	202,393

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

CHILKAT RIVER

Ericksen and Fleischman (*in prep*) developed a goal for the Chilkat River based on peak survey counts over an 18-year period in standardized locations within the drainage (Table 3.2, Figure 3.4). They expanded historical index counts based on companion mark-recapture estimates of escapement to the entire Chilkat drainage in four years (1990, 1998, 2002, and 2003). A *biological escapement goal* range of 950–2,200 spawners with a point goal of 1,550 spawners was proposed for the sum of index counts. The recommended target for total system escapement estimates is 30,000 to 70,000 spawners, with a point goal of 50,000 spawners.

The recommended goal for the Chilkat River was based upon three different analyses (traditional multiplicative Ricker spawner-recruit, Bayesian age-structured spawner-recruit, and a "hockeystick" model developed by Bradford et al. (1999) using known freshwater production) that produced nearly identical point estimates. All analyses included the stock assessment information from survey counts, mark-recapture estimates, harvest and smolt estimates from coded-wire tagging of several broods and age-structure data. The goal represents a best estimate of the range required to provide for maximum sustained yield and is designed to produce at least 90% of maximum sustained yield while reflecting the uncertainty associated with the data.

Table 3.14–Estimated harvest by gear type, escapement and total run of coho salmon returning to Chuck Creek and the Nakwasina River from 1982 to 2004.

		Number of fish						
Year	Fishery sample size	Troll	Seine	Gillnet	Sport	Total catch	Escapement	Return
Chuck Creek								
1982	28	1,320	418			1,738	1,017	2,755
1983	11	551	618			1,169	1,238	2,407
1985	29	1,906	975			2,881	956	3,837
2001							1,350	
2002							2,189	
2003	192	539	252		83	874	614	1,488
2004	203	725	179		76	980	606	1,586
Average		1,008	488		80	1,528	1,139	2,415
Nakwasina River								
2000	34	1,089	70	0	60	1,219	2,000	3,219
2001	93	1,178	39	0	222	1,439	2,992	4,431
2002	48	598	0	0	133	731	3,141	3,872
2003	33	489	0	0	115	604	2,063	2,667
2004	97	1,381	63	0	200	1,645	3,867	5,512
Average		947	34	0	146	1,128	2,813	3,940

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

KETCHIKAN AND SITKA AGGREGATE SURVEY COUNTS

Shaul and Tydingco (*in prep*) propose goals for aggregate spawner counts in 14 streams in the Ketchikan area and five streams in the Sitka area (Tables 3.3 and 3.4; Figures 3.5 and 3.6). Lack of adequate stock specific information on age composition, harvest and survey efficiency prevented them from undertaking a conventional spawner-recruit analysis. Instead, they incorporated exploitation rate and marine survival estimates for nearby wild indicator stocks (Hugh Smith Lake for Ketchikan, Nakwasina River for Sitka) to estimate smolt production associated with the aggregate survey counts. They estimated habitat capacity as average smolt production associated with primary brood years having higher levels of escapement, indicating probable full seeding of available rearing habitat. Average productivity estimates for coho stocks based on literature were incorporated to estimate the number of smolts/spawner associated with *maximum sustained yield* and a range producing an even proportion (84% or more) of *maximum sustained yield* in which the upper goal bound was at least double the lower bound.

JUNEAU ROADSIDE SURVEY COUNTS

Clark (*in prep*) developed escapement goals for Montana and Peterson Creeks based on theoretical spawner-recruit analysis. He used Auke Creek exploitation rates to determine an equilibrium point for potential Ricker relationships and applied a range of probable alpha values

Table 3.15–Estimated percent harvest by gear type, escapement, and total run of coho salmon returning to Auke Creek from 1980 to 2004

		Percentage of total run						
Year	Fishery sample size[a]	Troll	Seine	Drift gillnet	Sport	Total catch	Escapement	Total return
1980	15	13.5	0.0	3.3	2.8	19.6	80.4	100.0
1981	70	28.7	0.0	3.2	1.9	33.8	66.2	100.0
1982	45	20.2	15.8	3.2	0.3	39.5	60.5	100.0
1983	129	31.1	0.8	2.3	9.8	44.0	56.0	100.0
1984	124	34.0	0.7	1.2	4.7	40.5	59.5	100.0
1985	177	35.3	0.2	4.2	4.3	44.0	56.0	100.0
1986	110	43.2	0.2	6.2	3.8	53.4	46.6	100.0
1987	145	37.2	0.2	4.1	2.0	43.3	56.7	100.0
1988	145	25.5	1.0	6.0	4.6	37.1	62.9	100.0
1989	182	48.2	0.6	1.4	4.4	54.6	45.4	100.0
1990	168	42.8	1.0	3.8	5.3	53.0	47.0	100.0
1991	47	17.0	0.7	12.9	0.9	31.5	68.5	100.0
1992	53	32.2	0.5	10.5	2.5	45.6	54.4	100.0
1993	169	38.5	0.5	5.8	1.2	45.9	54.1	100.0
1994	330	34.8	7.3	7.1	3.7	53.0	47.0	100.0
1995	82	32.2	0.6	7.9	3.2	43.9	56.1	100.0
1996	160	39.1	1.0	11.7	3.2	54.9	45.1	100.0
1997	43	12.4	0.5	0.0	6.6	19.6	80.4	100.0
1998	157	30.9	1.2	3.0	3.8	39.0	61.0	100.0
1999	160	33.8	0.3	4.0	2.9	41.1	58.9	100.0
2000	103	23.5	0.6	2.4	3.0	29.5	70.5	100.0
2001	149	30.9	0.7	2.9	3.9	38.5	61.5	100.0
2002	125	18.0	0.5	4.8	3.2	26.5	73.5	100.0
2003	97	23.3	0.4	6.5	5.0	35.3	64.7	100.0
2004	62	26.6	6.3	9.5	2.0	44.4	55.6	100.0
Average		30.1	1.7	5.1	3.6	40.5	59.5	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

to establish a goal range likely to encompass 90% or more of maximum sustained yield. His recommended goals are 400–1,200 spawners for Montana Creek and 100–250 spawners for Peterson Creek. These target ranges replace goals developed by Clark (1995*b*) of 200–500 spawners and 100–350 spawners, respectively. Montana and Peterson Creeks both have freshwater sport fisheries that can be actively managed for escapement goals. Clark (*in prep*) recommended that goals for three other Juneau Roadside streams without freshwater fisheries (Steep, Jordan and Switzer Creeks) be eliminated.

DISCUSSION

The results of this analysis lead us to the same conclusion reached by Shaul et al. (2004): Southeast Alaska coho salmon stocks are currently in excellent overall condition. We found no *stocks of concern* from a fishery management perspective. Stocks that have *biological escapement goals* have been within or above target ranges in the vast majority of cases. For most

Table 3.16– Estimated percent harvest by gear type, escapement and total run of coho salmon returning to the Berners River from 1982 to 2004.

		Percent of total run								
Year	Fishery sample size[a]	Troll	Seine	Drift gillnet	Sport	B.C. net	Cost recovery	Total catch	Escapement	Total run
1982	48	41.6	0.0	34.1	0.0	0.0	0.0	75.8	24.2	100.0
1983	125	50.4	0.0	20.5	0.2	0.0	0.0	71.1	28.9	100.0
1984										
1985	93	44.8	0.8	28.9	0.0	0.0	0.0	74.6	25.4	100.0
1986	157	55.0	0.0	36.2	1.6	0.0	0.0	92.9	7.1	100.0
1987	53	53.0	0.0	23.5	0.3	0.0	0.0	76.8	23.2	100.0
1988	102	39.6	1.2	41.0	0.0	0.0	0.0	81.8	18.2	100.0
1989	58	53.4	0.0	8.5	0.0	0.0	0.0	61.9	38.1	100.0
1990	470	44.0	0.4	21.8	1.1	0.0	0.0	67.3	32.7	100.0
1991	1,025	18.2	1.6	47.0	0.3	0.0	0.0	67.2	32.8	100.0
1992	701	33.5	0.8	32.0	0.4	0.0	0.0	66.6	33.4	100.0
1993	1,496	39.0	0.4	28.7	0.3	0.0	0.0	68.4	31.6	100.0
1994	2,647	37.1	2.3	37.9	1.2	0.0	0.0	78.4	21.6	100.0
1995	1,384	30.7	0.1	51.6	0.4	0.0	0.0	82.8	17.2	100.0
1996	601	44.2	1.6	27.0	1.7	0.0	0.0	74.6	25.4	100.0
1997	312	15.9	1.8	16.0	1.2	0.0	0.0	34.9	65.1	100.0
1998	613	43.9	1.8	24.1	1.6	0.0	0.0	71.4	28.6	100.0
1999	948	39.5	0.6	28.6	0.8	0.0	0.0	69.6	30.4	100.0
2000	693	24.8	0.7	24.5	0.9	0.0	0.0	50.8	49.2	100.0
2001	745	27.7	0.6	10.9	0.4	0.0	0.0	39.6	60.4	100.0
2002	787	17.3	0.5	26.0	0.9	0.0	0.0	44.7	55.3	100.0
2003	1,326	23.7	0.9	39.0	1.6	0.0	0.0	65.1	34.9	100.0
2004	756	32.5	0.3	22.4	0.7	0.0	0.0	55.8	44.2	100.0
Average		36.8	0.7	28.6	0.7	0.0	0.0	66.9	33.1	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

stocks, escapements peaked in the early to mid-1990s when runs were exceptionally strong and have reached relatively high levels again during 2001 to 2004 because of strong runs combined with lower exploitation rates for some stocks. Ocean conditions that favor survival of local coho salmon stocks in Southeast Alaska persisted through the 2004 return.

Improvement in salmon prices in 2004 helped reverse a decline in fishing effort in troll and net fisheries brought on by very depressed markets for salmon in 2002 and 2003. Troll fishery exploitation rates in particular increased markedly in 2004, reaching the highest level since the 1990s for most stocks. This development represents a relatively rapid if not complete reversal of the situation described by Shaul et al. (2004) in which exploitation rates had fallen to the point were very little active fishery management was needed.

Table 3.17–Estimated percent harvest by gear type, escapement, and total run of coho salmon returning to Ford Arm Lake from 1982 to 2004.

		Percent of total run							
Year	Fishery sample size[a]	Alaska troll	Seine	Drift gillnet	Sport	Canadian troll	Total catch	Escapement	Total run
1982	38	41.3	2.2	0.0	0.0	0.0	43.6	56.4	100.0
1983	93	54.0	14.7	0.0	0.0	0.0	68.7	31.3	100.0
1984									
1985	49	51.2	0.0	0.0	0.0	0.0	51.2	48.8	100.0
1986	87	60.9	1.5	0.0	0.0	0.0	62.4	37.6	100.0
1987	71	45.1	2.4	0.0	0.0	0.0	47.5	52.5	100.0
1988	151	47.9	0.8	0.0	0.0	0.5	49.2	50.8	100.0
1989	221	61.5	3.0	0.0	0.0	0.0	64.5	35.5	100.0
1990	174	56.5	2.0	0.0	0.0	0.0	58.5	41.5	100.0
1991	193	53.3	0.7	0.2	0.0	0.0	54.2	45.8	100.0
1992	199	56.4	2.2	0.0	0.0	0.0	58.7	41.3	100.0
1993	349	61.8	3.5	0.0	1.6	0.0	66.9	33.1	100.0
1994	236	60.2	10.7	0.0	1.0	0.0	71.9	28.1	100.0
1995	91	47.8	19.6	0.0	0.0	0.0	67.4	32.6	100.0
1996	64	52.6	0.0	0.0	5.6	0.0	58.2	41.8	100.0
1997	241	47.8	0.0	0.0	3.6	0.0	51.4	48.6	100.0
1998	315	48.9	2.7	0.1	4.2	0.0	56.0	44.0	100.0
1999	145	58.9	0.7	0.0	4.4	0.0	63.9	36.1	100.0
2000	193	57.2	11.5	0.2	2.7	0.0	71.6	28.4	100.0
2001	131	67.7	1.3	0.0	5.6	0.0	74.6	25.4	100.0
2002	246	38.0	8.3	0.0	6.6	0.0	53.0	47.0	100.0
2003	225	31.4	3.8	0.0	13.4	0.0	48.6	51.4	100.0
2004	153	63.8	4.3	0.0	2.6	0.0	70.8	29.2	100.0
Average		52.9	4.4	0.0	2.3	0.0	59.7	40.3	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

Although we identified no *stocks of concern* from a fishery management perspective, the Joint Northern Boundary Technical Committee (2002) described land-use practices in the region that have likely reduced habitat capability for coho salmon. Most habitat loss is a long-term ongoing process resulting from historical forestry practices that have resulted in loss and reduced recruitment of woody debris in stream channels. Problems have also been identified with improperly installed culverts that block fish passage under logging roads. These effects apply primarily to smaller streams in areas where timber has been harvested. Most wetland habitat that is essential to coho salmon production in larger mainland river systems is in nearly pristine condition.

Urbanization impacts are minor over most of the region, but we noted decreases in two Juneau roadside stocks that may have been related to the ongoing process of urban development. The declines appear unrelated to fishery effects on spawning escapement, but natural habitat changes and ecological shifts cannot be ruled out.

Table 3.18–Estimated harvest by gear type, escapement and total run of coho salmon returning to Hugh Smith Lake from 1982 to 2004.

		Percent of total run										
Year	Fishery sample size[a]	Alaska troll	Alaska seine	Alaska gillnet	Alaska trap	Alaska sport	B.C. troll	B.C. net	B.C. sport	Total catch	escapement	Total return
1982	91	45.6	10.3	3.3	0.0	0.0	4.3	1.3	0.0	64.8	35.2	100.0
1983	189	35.4	10.9	7.1	1.3	0.0	5.4	1.3	0.0	61.5	38.5	100.0
1984	151	31.4	12.5	11.7	0.4	0.0	8.1	0.7	0.0	64.9	35.1	100.0
1985	212	36.0	11.9	5.7	0.2	0.0	8.3	0.5	0.0	62.6	37.4	100.0
1986	257	35.4	11.5	7.0	0.0	0.3	5.2	0.6	0.0	60.1	39.9	100.0
1987	100	28.0	4.1	10.6	0.0	1.0	6.5	2.1	0.0	52.3	47.7	100.0
1988	42	26.7	15.0	8.0	0.0	0.0	15.3	1.5	0.0	66.5	33.5	100.0
1989	91	50.0	15.5	9.8	0.0	1.7	4.3	0.8	0.0	82.1	17.9	100.0
1990	263	39.4	11.7	11.0	0.5	0.0	17.3	1.2	0.0	81.1	18.9	100.0
1991	408	36.7	3.4	15.4	0.0	0.9	11.0	0.8	0.0	68.1	31.9	100.0
1992	497	37.9	13.8	12.3	0.0	0.9	5.8	0.2	0.0	70.8	29.2	100.0
1993	162	52.9	6.1	15.9	0.0	0.0	4.6	1.0	0.0	80.6	19.4	100.0
1994	846	45.9	11.9	15.1	0.0	0.6	7.2	0.6	0.1	81.4	18.6	100.0
1995	433	30.1	13.4	24.4	0.0	1.5	3.6	0.4	0.2	73.6	26.4	100.0
1996	496	40.4	16.3	12.2	0.0	2.7	3.2	0.9	0.0	75.7	24.3	100.0
1997	481	48.5	4.6	15.0	0.0	1.0	3.4	0.0	0.0	72.4	27.6	100.0
1998	666	41.0	10.9	22.7	0.0	2.6	0.0	0.0	0.0	77.2	22.8	100.0
1999	493	42.1	7.0	17.4	0.0	3.7	0.0	0.0	0.0	70.2	29.8	100.0
2000	161	36.3	3.3	8.6	0.0	7.2	0.0	0.0	0.0	55.5	44.5	100.0
2001	314	22.3	14.6	10.4	0.0	1.9	0.2	0.0	0.0	49.4	50.6	100.0
2002	433	16.6	8.4	10.3	0.0	1.7	1.2	0.0	0.7	38.9	61.1	100.0
2003	336	24.4	9.6	18.8	0.0	2.9	2.5	0.7	0.0	58.9	41.1	100.0
2004	244	40.9	7.9	9.3	0.0	2.4	1.9	0.8	2.9	66.2	33.8	100.0
Average		36.7	10.2	12.3	0.1	1.4	5.2	0.7	0.2	66.7	33.3	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

The Auke Creek stock has undergone a gradual but relatively steady decline in smolt production of about 1.5% of the year-zero reference point per year over the 26-year history of the indicator stock, for a total decline of 38%. The reason for the decline is unclear but does not appear related to a limitation in the number of spawners, as spawning escapement has not shown a corresponding trend. Shaul et al. (2004) reviewed hypotheses about habitat and species changes in the heavily developed system and their potential effect on smolt production.

Jordan Creek, located in a heavily developed section of the Mendenhall Valley, experienced a sharp drop in escapement beginning in 1995, with escapements falling under the goal existing at that time for five consecutive years. The decline was disproportionate with changes in escapement in other Juneau roadside streams. However, the goal was achieved in the following three years and a record count of 1,396 spawners occurred in 2002. This was followed two years later by a peak count of only 38 spawners in 2004. Shaul et al. (2004) concluded that the recent history of highly variable escapements in Jordan Creek, combined with widely disparate smolt counts in 2001 and 2002, suggested that survival and smolt production from the system had been particularly sensitive to environmental conditions.

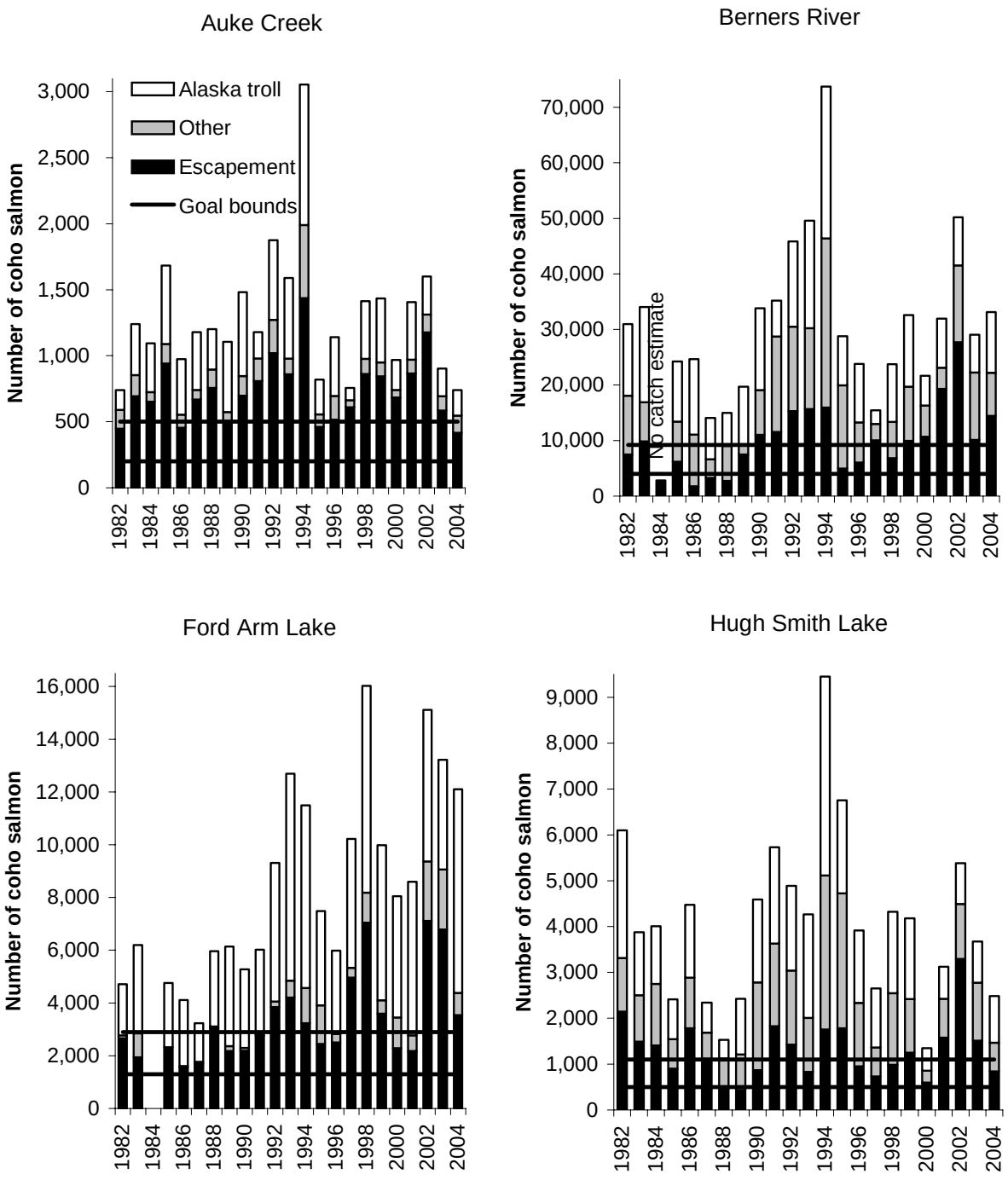

Figure 3.9–Total run size, catch, escapement and biological escapement goal range for four wild Southeast Alaska coho salmon indicator stocks from 1982 to 2004.

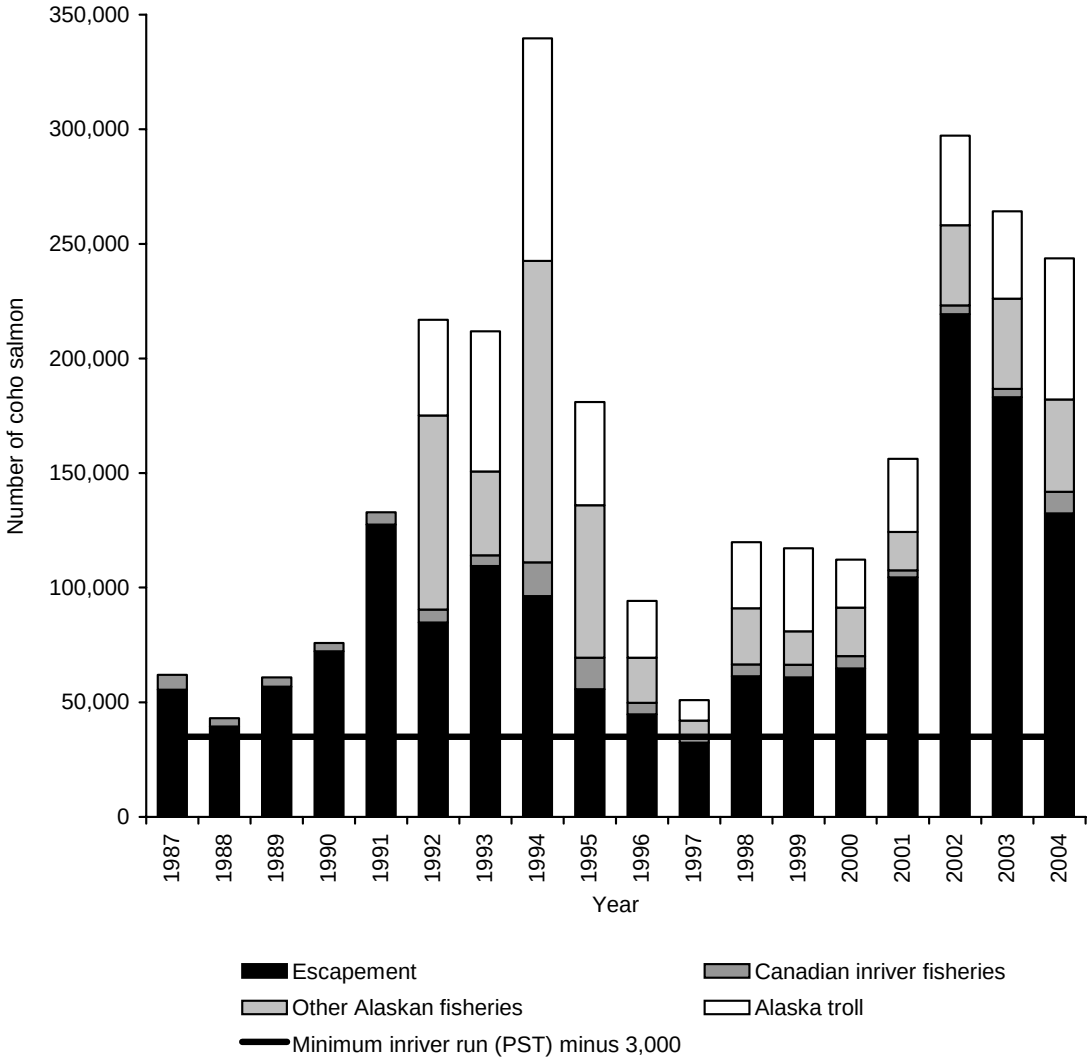

Figure 3.10–Total estimated run size, catch, and escapement of coho salmon bound for the Taku River above Canyon Island from 1987 to 2004. There are no catch estimates for 1987 to 1991.

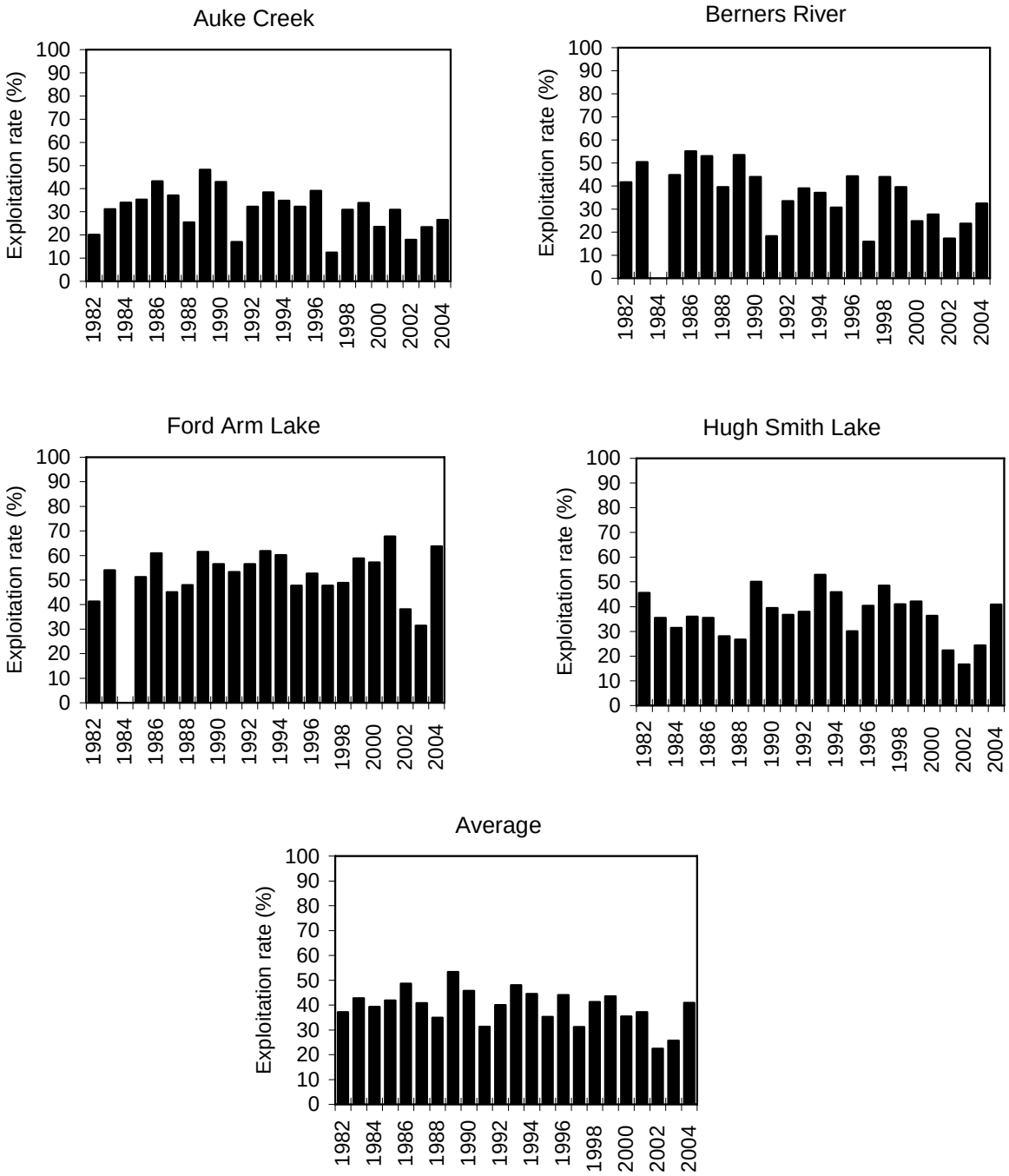

Figure 3.11–Estimated exploitation rates by the Alaskan troll fishery for four coded wire tagged Southeast Alaska coho stocks from 1982 to 2004.

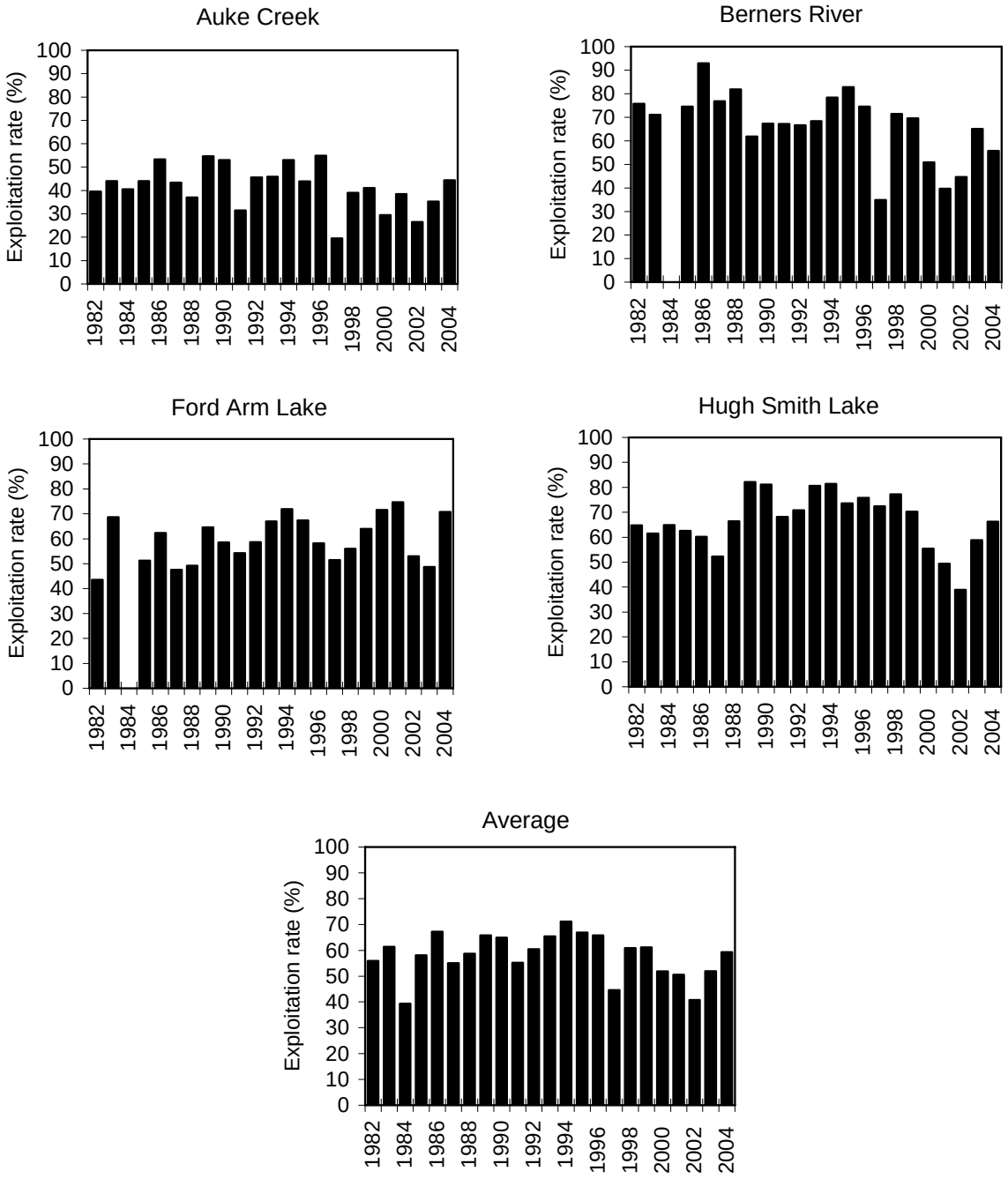

Figure 3.12–Estimated total exploitation rates by all fisheries for four coded wire tagged Southeast Alaska coho stocks from 1982 to 2004.

Table 3.19–Estimated percent of harvest by gear type, escapement, and total run of coho salmon returning to the Taku River above Canyon Island from 1992 to 2004.

		Percent of total run							
Year	Fishery sample size[a]	Troll	Seine	Gillnet	Marine sport	Canadian inriver	Total catch	Escapement	Return
1992	129	19.2	2.3	35.2	1.5	2.6	60.9	39.1	100.0
1993	121	28.9	1.3	14.8	1.2	2.2	48.3	51.7	100.0
1994	178	28.6	7.8	25.4	5.6	4.3	71.6	28.4	100.0
1995	201	24.9	1.0	31.4	4.3	7.6	69.2	30.8	100.0
1996	136	26.3	0.2	18.1	2.6	5.4	52.6	47.4	100.0
1997	66	26.3	0.2	18.1	2.6	5.4	52.6	47.4	100.0
1998	231	24.1	0.6	16.2	3.7	4.2	48.8	51.2	100.0
1999	252	30.9	2.5	6.4	3.6	4.8	48.1	51.9	100.0
2000	221	18.8	1.4	8.8	8.5	4.9	42.4	57.6	100.0
2001	344	20.5	1.3	7.3	2.1	2.0	33.2	66.8	100.0
2002	397	13.1	1.2	8.2	2.4	1.3	26.2	73.8	100.0
2003	195	14.4	1.4	11.0	2.5	1.4	30.8	69.3	100.0
2004	223	25.2	2.2	11.9	2.5	3.9	45.7	54.3	100.0
1992-2004 Average		23.2	1.8	16.4	3.3	3.8	48.5	51.5	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

Stocks that experienced a substantial increase in estimated freshwater production over the previous decade or more include Ford Arm Lake and the Taku River. Both are relatively pristine watersheds. Shaul et al. (2004) speculated that recent increases in nutrient loading from salmon carcasses likely contributed to increased pre-smolt production at Ford Arm Lake. However, we know of no evidence for a particular factor that likely resulted in increased smolt production from the Taku River.

Overall, we believe variation in smolt production and adult runs have been influenced primarily by environmental conditions rather than variations in escapement. Recent spawning escapements have been abundant by historical comparison in most streams, and escapement goals have usually been met or exceeded, suggesting that available rearing habitat has been fully seeded in most cases. Average marine survival rates for four long-term indicator stocks during 1995–2004 ranged from 10–22% with a mean-average of 15%. These averages are higher than average survival rates in the 1980s and the trend in the commercial harvest of wild coho salmon suggests that recent survival rates have averaged well above those that prevailed during the mid-1950s to early 1980s.

Exploitation rates increased substantially in 2004 following a period of low exploitation rates during 2000–2003 that were likely constrained by low fishing effort in response to low salmon prices. In particular, troll fishery exploitation rates increased in 2004 to a level for most stocks that was equal to or higher than average rates prior to 2000. Drift gillnet exploitation rates remained reduced from pre-2000 averages, in most cases, but marine sport exploitation rates have trended upward in response to increased participation by charter vessels and have reached as high as 5–13% for some stocks during 2000–2004.

Table 3.20–Estimated percent of harvest by gear type, escapement and total run of coho salmon returning to the Chilkat River, Nakwasina River and Chuck Creek, 1982-2004.

		Percent of total run							
Year	Fishery sample size[a]	Troll	Seine	Gillnet	Sport	Subsistence	Total catch	Escapement	Total return
Chilkat River									
2000	265	17.6	0.7	12.6	1.4	0.2	32.4	67.6	100.0
2001	251	20.1	0.4	9.0	1.9	0.1	31.6	68.4	100.0
2002	352	19.7	0.3	13.6	2.0	0.2	35.7	64.3	100.0
2003	426	23.5	0.6	11.9	2.9	0.2	39.1	60.9	100.0
2004	258	43.1	0.5	17.6	5.5	0.2	66.9	33.1	100.0
Average		24.8	0.5	12.9	2.7	0.2	41.1	58.9	100.0
Nakwasina River									
2000	34	33.8	2.2	0.0	1.9	0.0	37.9	62.1	100.0
2001	93	26.6	0.9	0.0	5.0	0.0	32.5	67.5	100.0
2002	48	15.4	0.0	0.0	3.4	0.0	18.9	81.1	100.0
2003	33	18.3	0.0	0.0	4.3	0.0	22.6	77.4	100.0
2004	97	25.1	1.1	0.0	3.6	0.0	29.8	70.2	100.0
Average		23.8	0.8	0.0	3.6	0.0	28.3	71.7	100.0
Chuck Creek									
1982	28	47.9	15.2	0.0	0.0	0.0	63.1	36.9	100.0
1983	11	22.9	25.7	0.0	0.0	0.0	48.6	51.4	100.0
1985	29	49.7	25.4	0.0	0.0	0.0	75.1	24.9	100.0
2003	192	36.2	16.9	0.0	5.6	0.0	58.7	41.3	100.0
2004	203	45.7	11.3	0.0	4.8	0.0	61.8	38.2	100.0
Average		40.5	18.9	0.0	2.1	0.0	61.5	38.5	100.0

[a] Fishery sample size pertains to the total observed number (not expanded) of coded wire tags recovered each year.

Accurate inseason assessment of abundance will continue to be the most important informational aspect of fishery management. However, fishery managers will need to continue to account for fluctuating fishing effort and harvesting efficiency in order to more closely achieve target escapement ranges, including *biological escapement goals* for the Chilkat River and streams near Ketchikan and Sitka.

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